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# DATA CABLING - CRAWLING OUT OF THE MELTING POT?

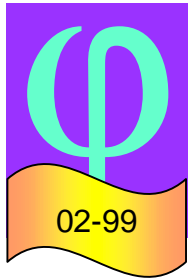
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prepared and delivered

by

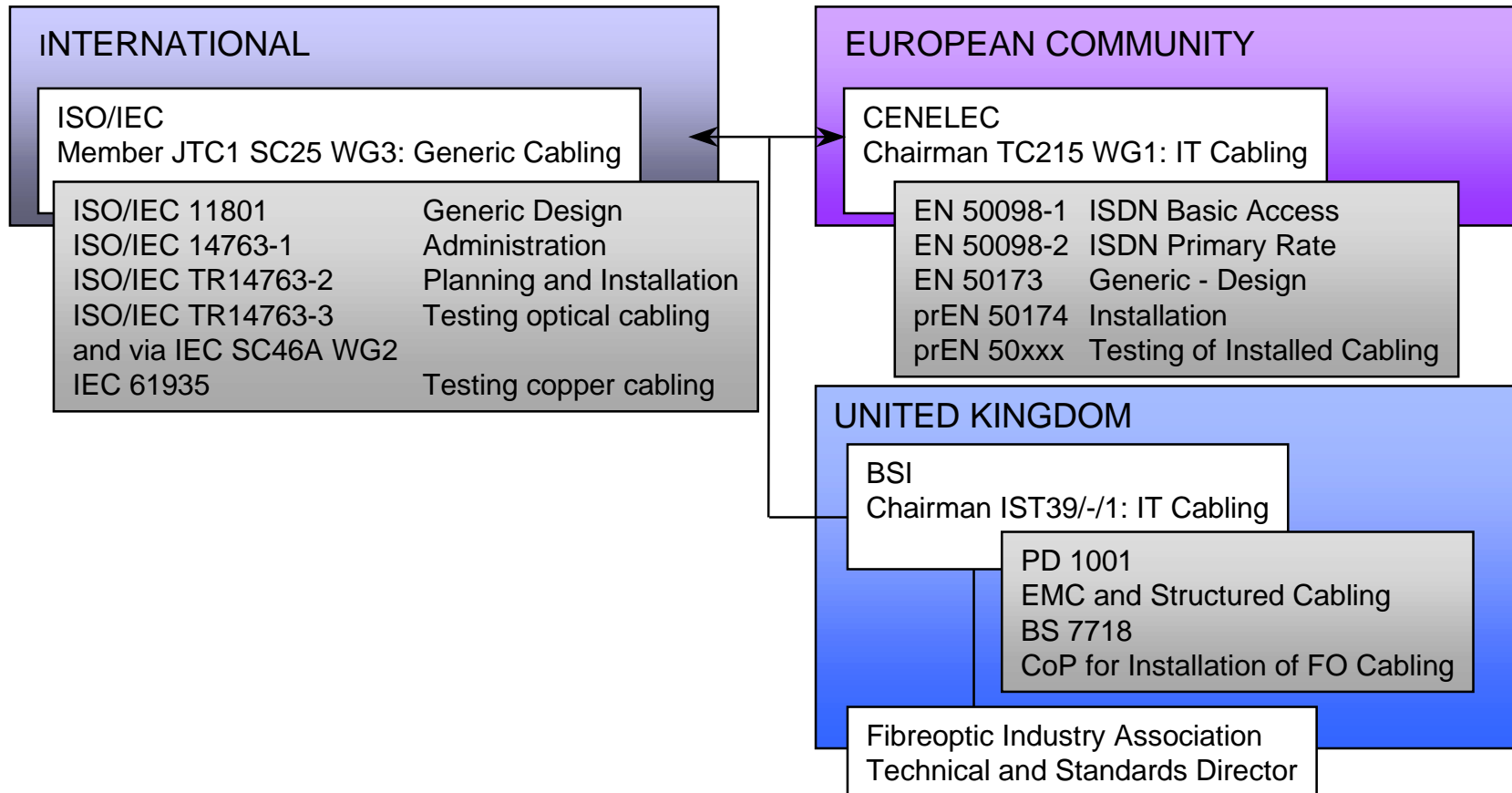


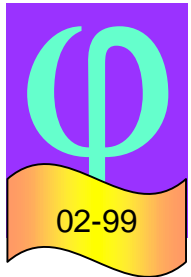
BSI,  
Chiswick, London  
24th February 1999



# Mike Gilmore

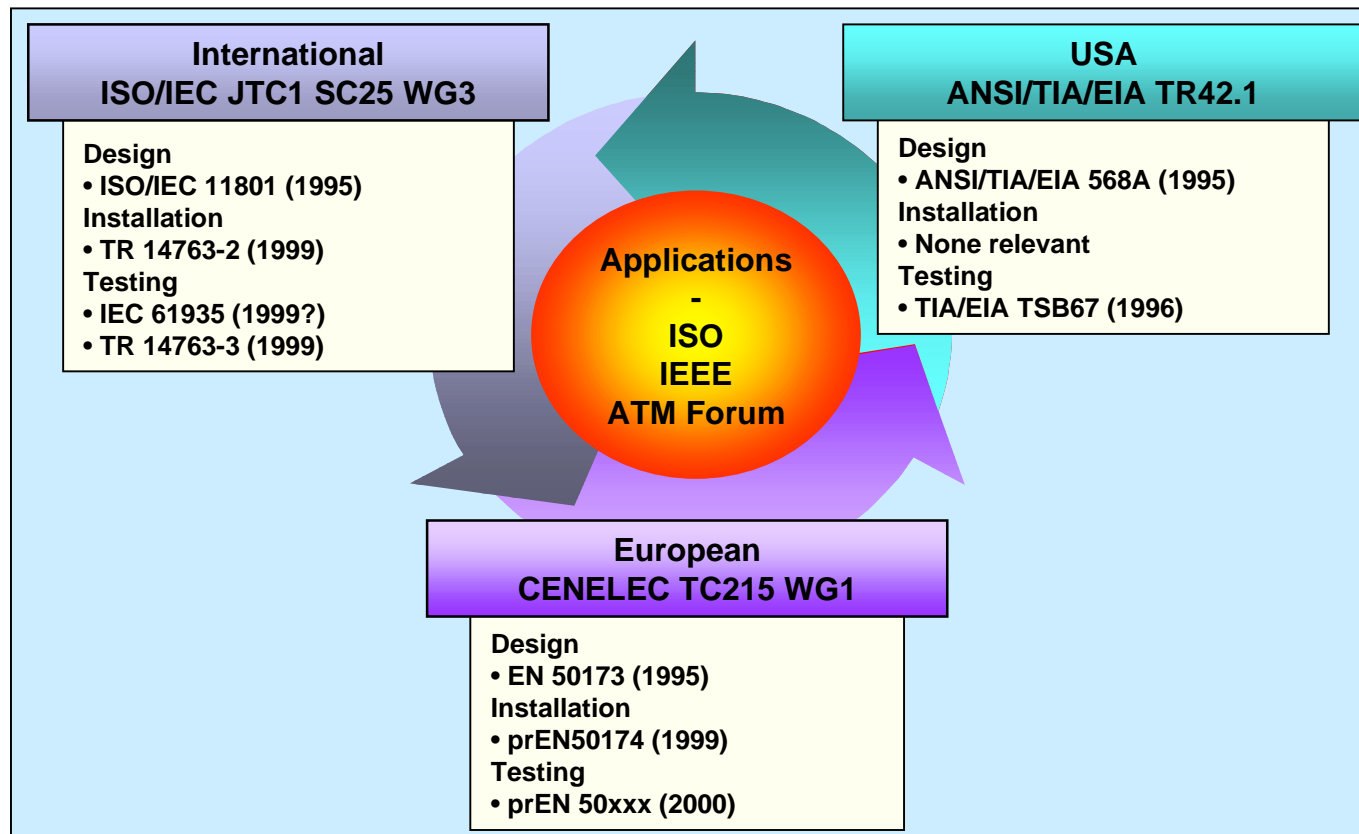
Senior Partner, The Cabling Partnership

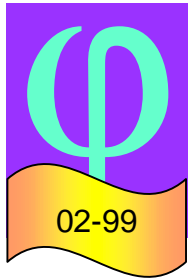




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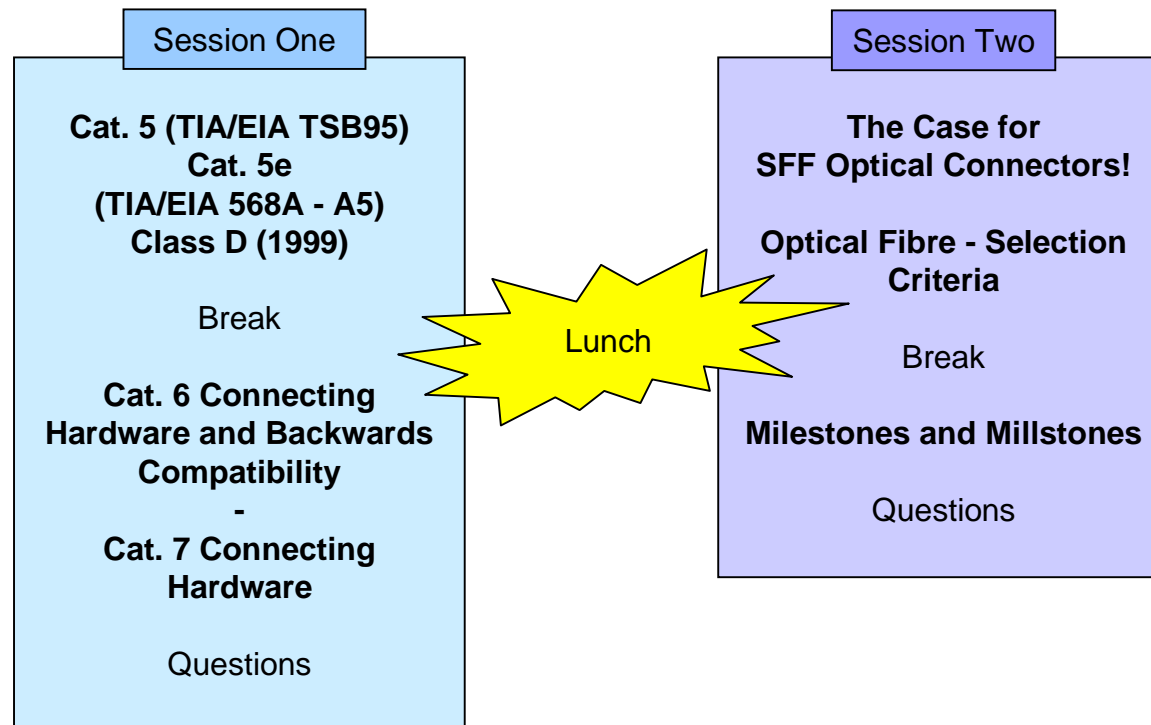
# The Cabling Standards Process

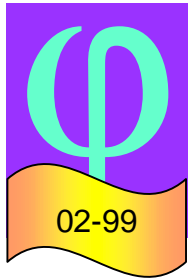




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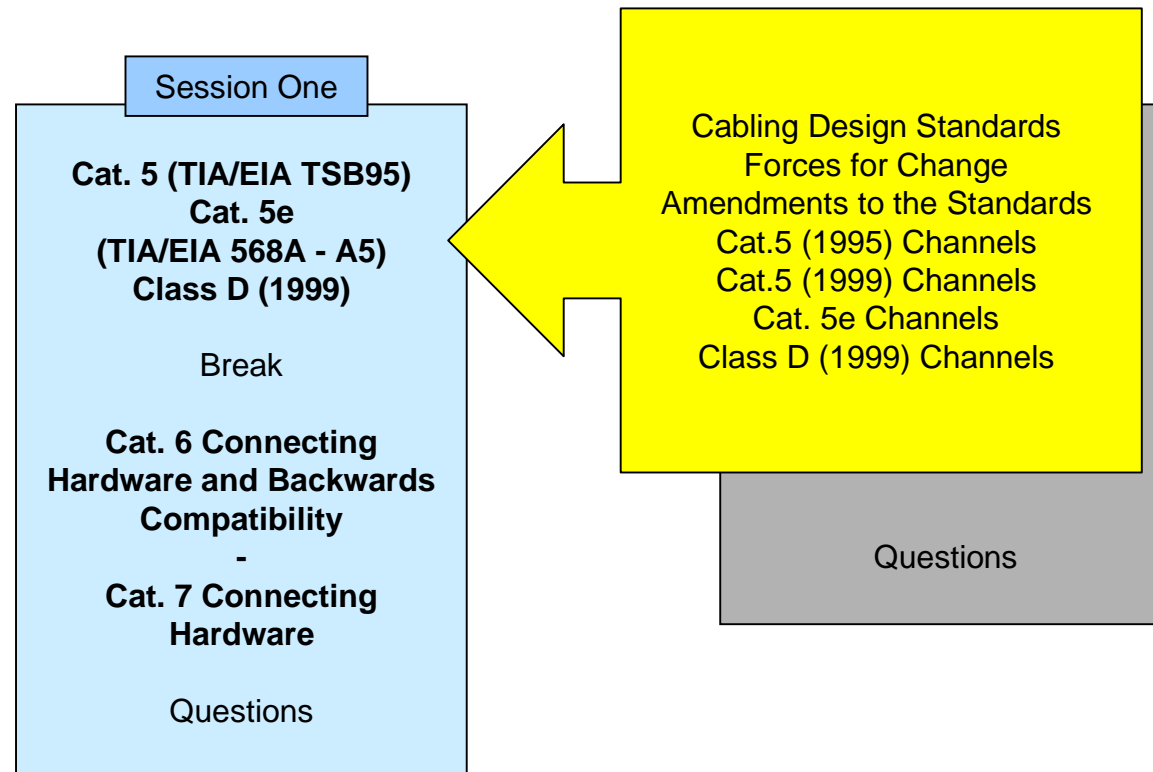
# Agenda





## DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda





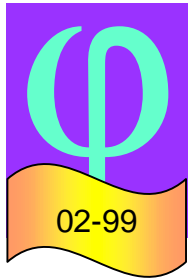
DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Cabling Design Standards

INTERNATIONAL  
IS 11801 (1995)  
Information Technology  
Generic Cabling for Customer Premises

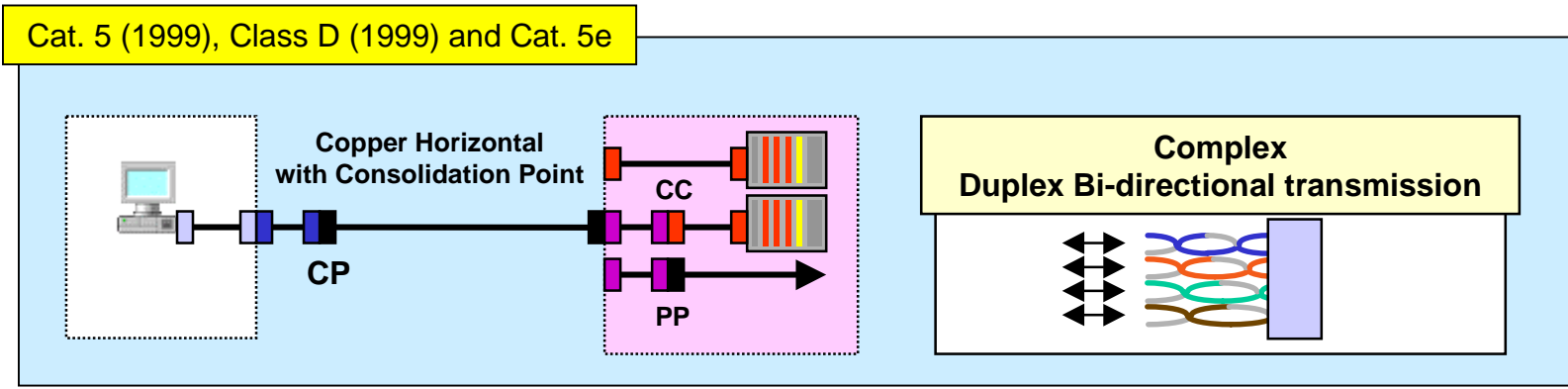
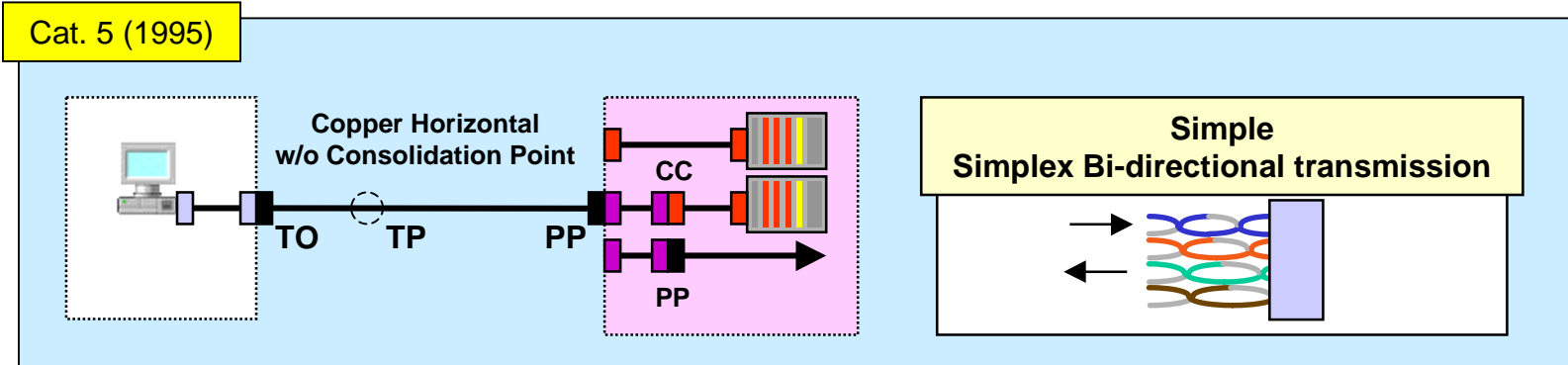
EUROPEAN  
EN 50173 (1995)  
Information Technology  
Generic Cabling Systems

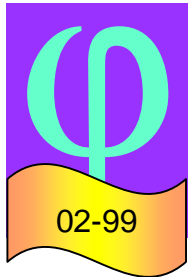
UNITED STATES  
ANSI/TIA/EIA 568A  
Commercial Building  
Telecommunications Cabling Standard



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Forces for Change





DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Amendments to the Standards

## ANSI/TIA/EIA 568A

### Continuous amendment

#### **Addendum 1**

Propagation delay and delay skew

#### **Addendum 2**

Additional requirements for NEXT of connecting hardware

#### **Addendum 3**

Bundled cables

#### **Addendum 4 (1999)**

Testing of patch cords

#### **Addendum 5 (1999)**

Cat. 5e parameters for components and installed cabling

## TIA/EIA TSB95A

Additional Cat. 5 parameters for 1000BASE-T

## IS 11801 (1995)

### **Amendment 1 (1999)**

Minor fixes

### **Amendment 2 (1999)**

Requirements for installed base to support 1000BASE-T

-

Complete parameter set included for links and channels

-

No changes to component specifications

(new component specifications will be referenced in revision of ISO/IEC 11801)

## BS EN 50173 (1995)

### **Amendment 1 (1999)**

Requirements for installed base to support 1000BASE-T

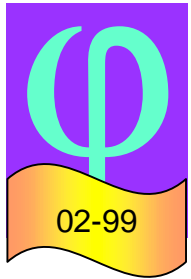
-

Complete parameter set included for links and channels

-

No changes to component specifications

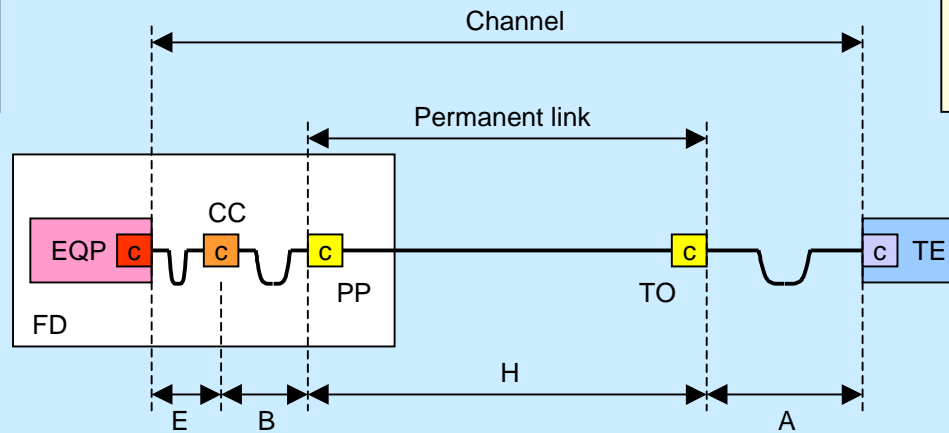
(new component specifications will be referenced in revision of EN 50173)



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Cat. 5 (1995) Channels

ANSI/TIA/EIA 568A (1995)  
 ISO/IEC 11801 (1995)  
 BS EN50173 (1995)



Cat. 5 (1995) Channel  
 using  
 Category 5 (1995) components

All applications supported except for:

- ATM-155  
*best pairs assumed*
- 1000BASE-T  
*many required parameters not specified*

Maximum channel length = 100 metres  
 H = 90 metres maximum

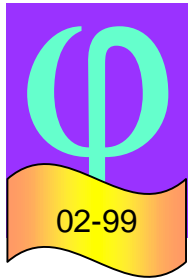
$$X = A+B+E$$

$$X = (102 - H)/P \text{ or alternatively } H = 102 - PX$$

P = 1.2 for unscreened cables leading to 90+10 concept  
 P = 1.5 for screened cables leading to 90+8 concept

Indirect support for Consolidation Point given by a reduction of 2 metres in horizontal model  
 i.e.  
 $X = (100 - H)/P$   
 $H = 100 - PX$

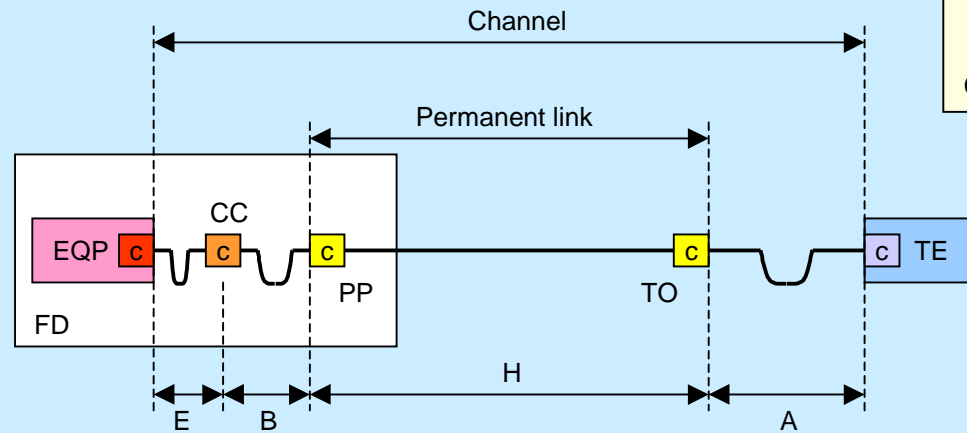
No guaranteed support for Consolidation Point



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Cat. 5 (1999) Channels

TIA/EIA TSB95



Cat. 5 (1999) Channel using Category 5 (1999) components

All applications supported

Maximum channel length = 100 metres  
 H = 90 metres maximum

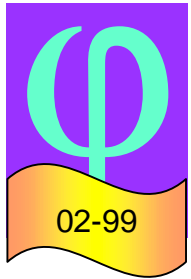
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 $H = 100 - PX$

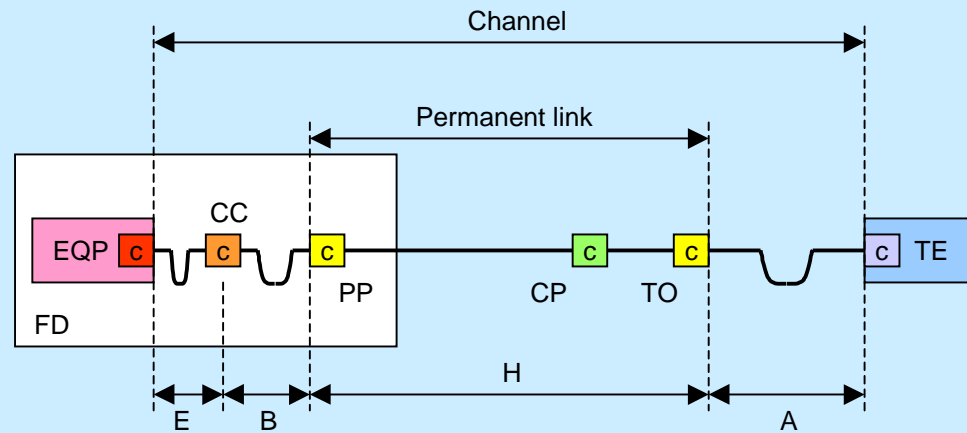
No guaranteed support for Consolidation Point or Crossconnect for 1000BASE-T



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Cat 5e Channels

ANSI/TIA/EIA 568A A5

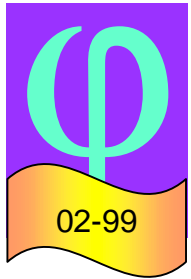


Cat. 5e Channel using Category 5e components

All applications supported with Consolidation Point and Crossconnect

Maximum channel length = 100 metres  
 H = 90 metres maximum  
 $X = A+B+E$   
 $X = (102 - H)/P$  or alternatively  $H = 102 - PX$   
 P = 1.2 for unscreened cables leading to 90+10 concept  
 P = 1.5 for screened cables leading to 90+8 concept

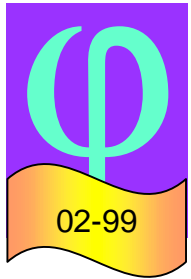
Indirect support for Consolidation Point for all applications given by a reduction of 2 metres in horizontal model  
 i.e.  
 $X = (100 - H)/P$   
 $H = 100 - PX$



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

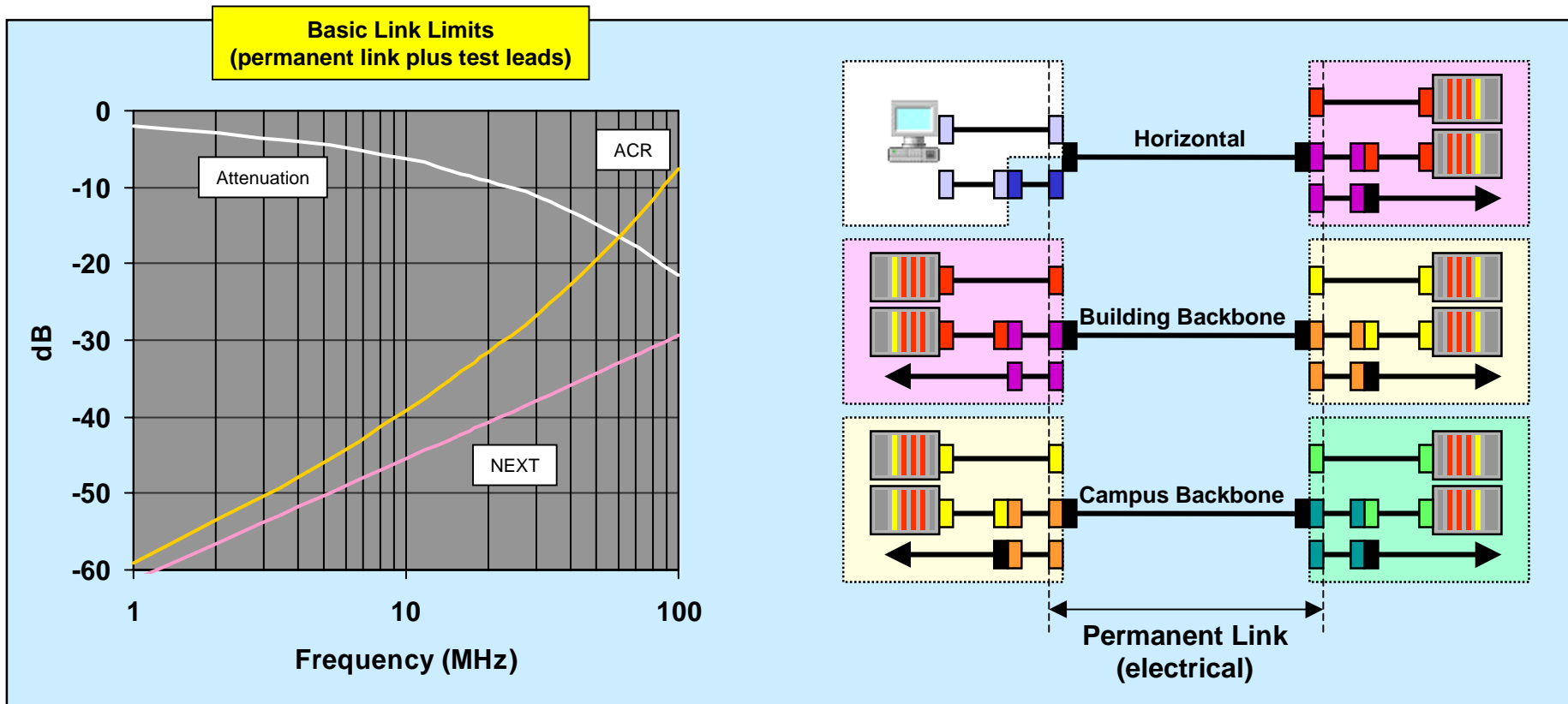
# Support for 1000BASE-T

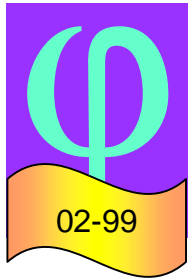
- United States
  - Category 5 (1995)
    - level of support is unknown
    - absence of complete specification
  - Category 5 (1999)
    - TIA/EIA TSB95
    - support for 2 connector model
  - Category 5e
    - ANSI/TIA/EIA 568A A5
    - support for 4 connector model
- ISO/IEC and CENELEC
  - Category 5 (1995)
    - level of support is unknown
    - absence of complete specification
  - Class D links and channels
    - ISO/IEC 11801 A2
    - EN 50173 A1
    - support for 3 connector model
    - installed requirements
      - no component changes



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

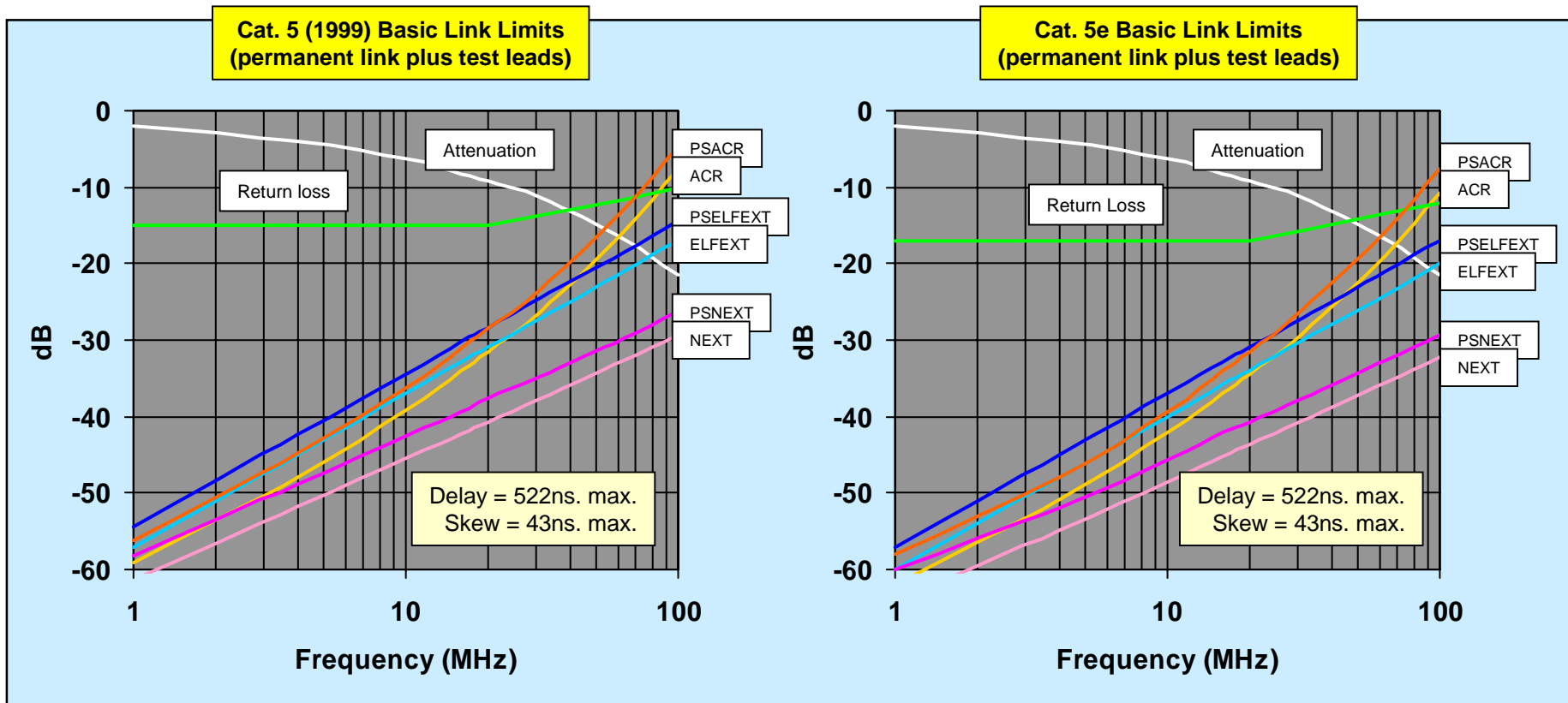
# Cat.5 (1995 -1998) Links

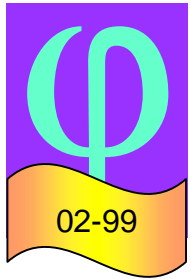




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Cat.5 (1999) and Cat. 5e Links

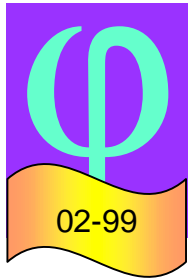




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

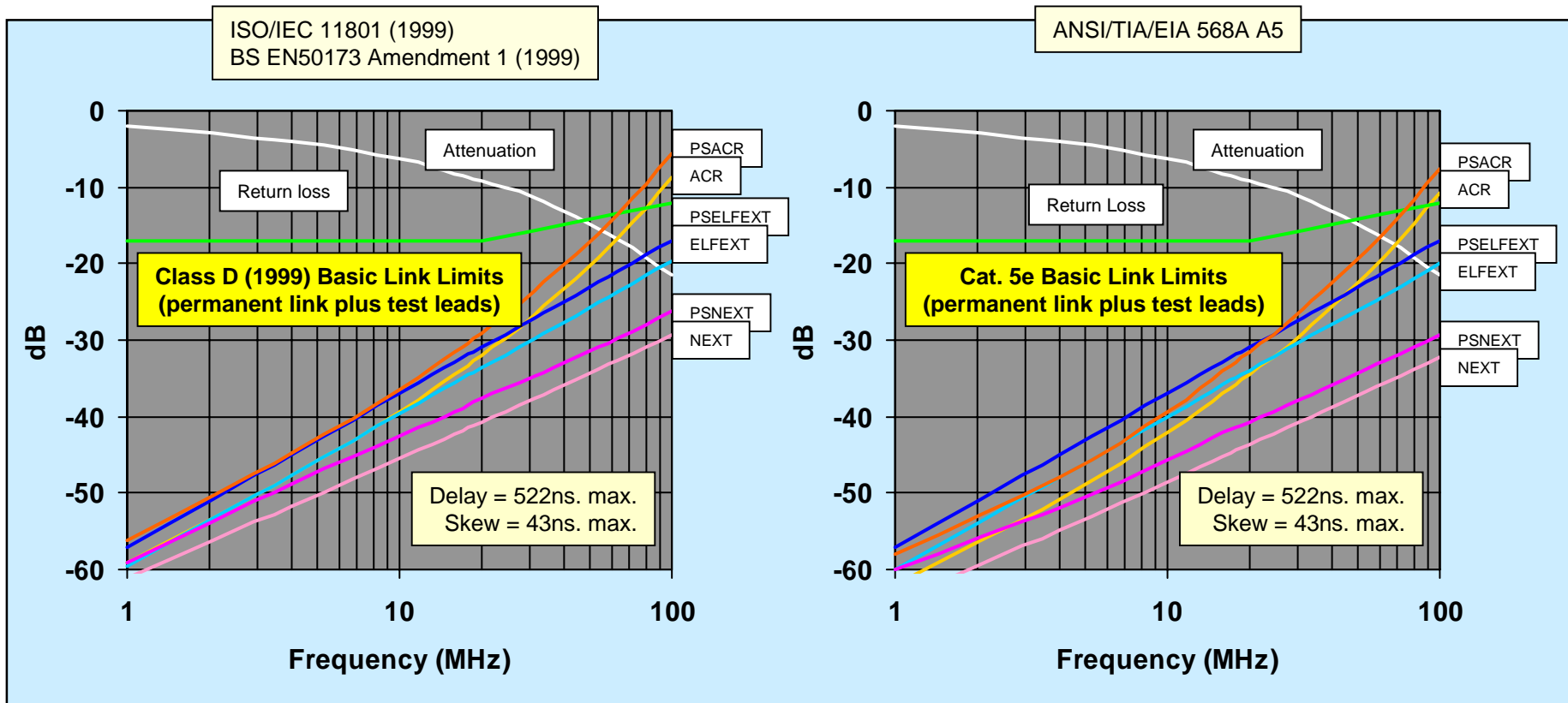
# Status of Amendments

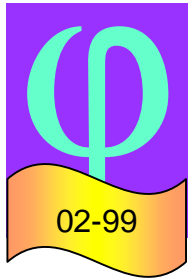
- TIA/EIA TSB95
  - predicted publication Q1, 1999
- ANSI/TIA/EIA 568A
  - Addendum 5
  - delayed due to return loss issues
    - links and channels stable
    - components under review
  - predicted publication Q3, 1999
- ISO/IEC 11801 Amendment 2
  - passed stage 1
  - predicted publication Q3, 1999
- EN 50173 Amendment 1
  - in stage 1
  - predicted publication Q3, 1999



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

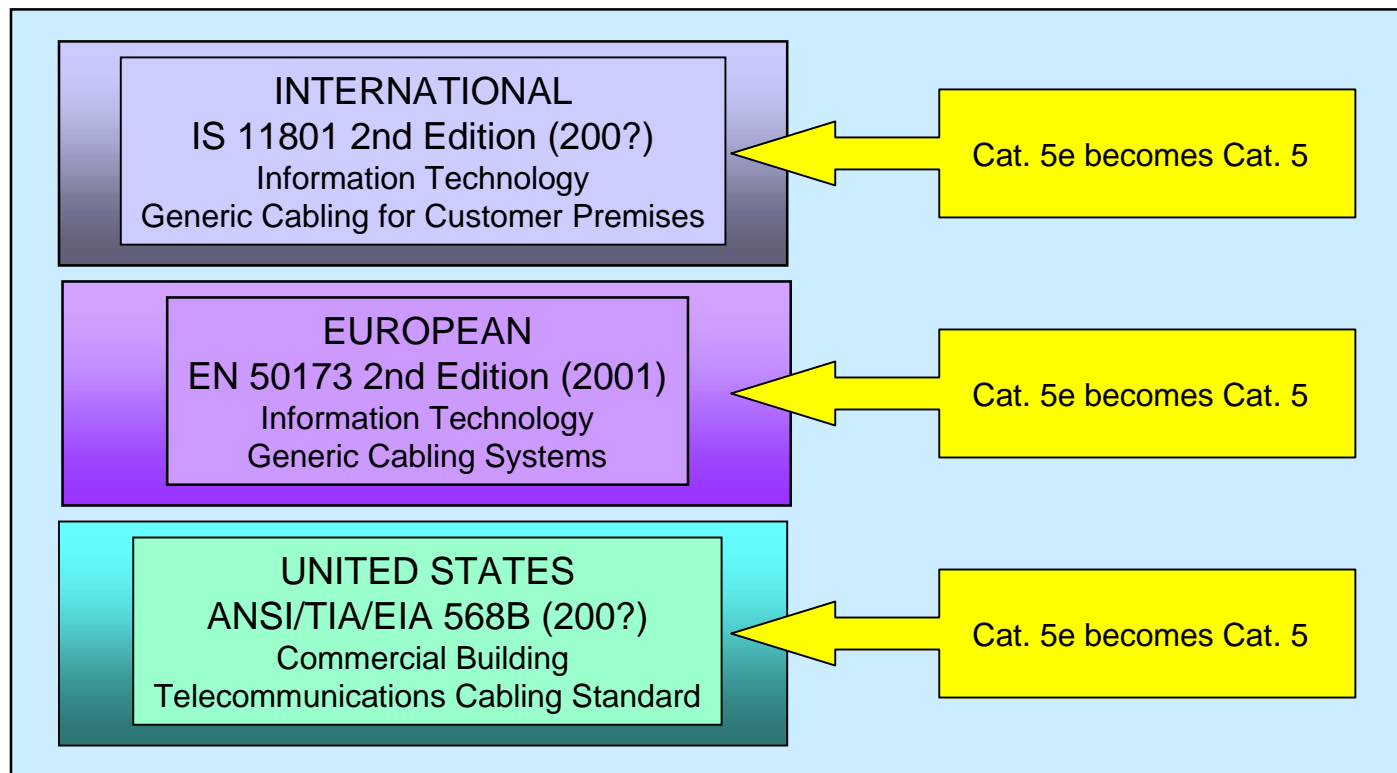
# Class D (1999) and Cat. 5e

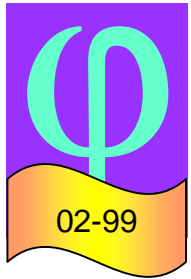




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Design Standard Revision





DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda

## Session One

**Cat. 5 (TIA/EIA TSB95)  
Cat. 5e  
(TIA/EIA 568A - A5)  
Class D (1999)**

**Cat. 6 Connecting  
Hardware and Backwards  
Compatibility**

**-  
Cat. 7 Connecting  
Hardware**

Questions

Break

## Session Two

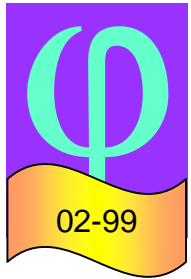
**The Case for  
SFF Optical Connectors!**

**Optical Fibre - Selection  
Criteria**

Break

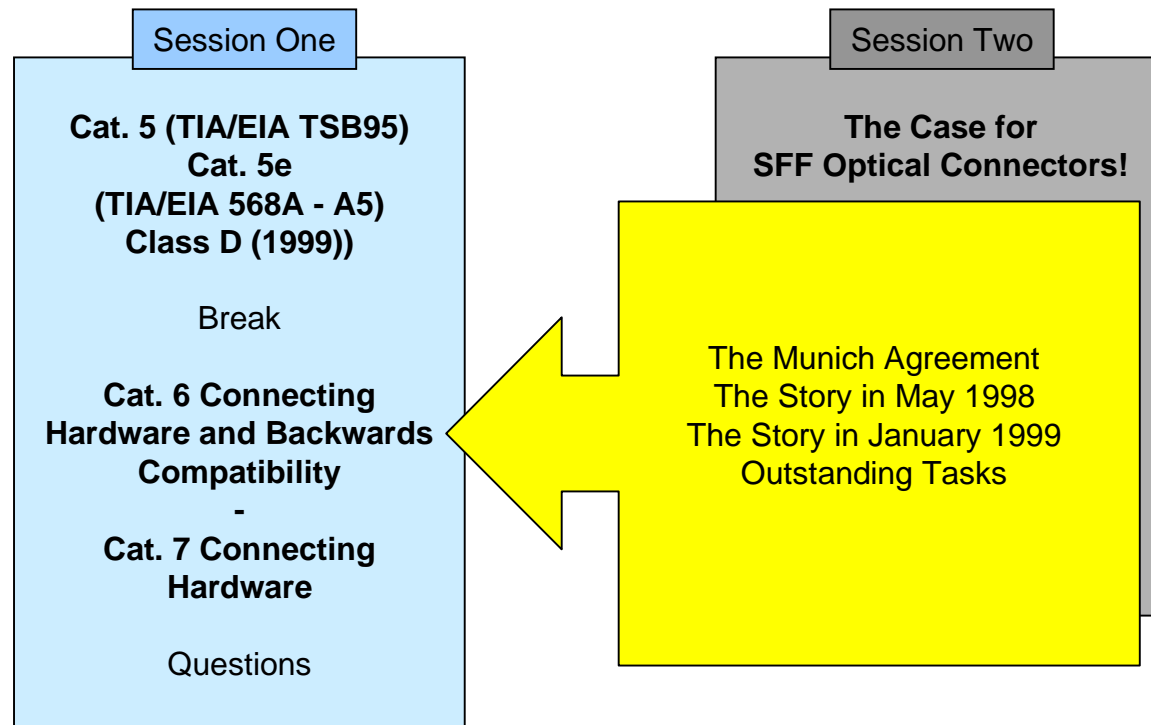
**Milestones and Millstones**

Questions



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda





DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# The Munich Agreement

- **Class E - Category 6**
  - 4 pair solution
  - 4 connection model (CP and CC)
  - positive PSACR at 200MHz
  - supported over
    - unscreened balanced pairs
    - foil screened balanced pairs
    - IEC 60603-7 connectivity

- **Class F - Category 7**
  - 4 pair solution
  - 4 connection model (CP and CC)
  - positive PSACR at 600MHz
  - supported over
    - individually screened balanced pairs
    - new connector

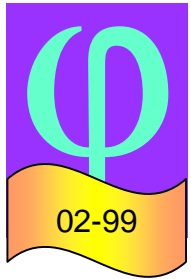
Existing standards text from BS EN 50173 (1995)

„Links of a given class will support all applications of a lower link class.

Link class A is regarded as the lowest class.“

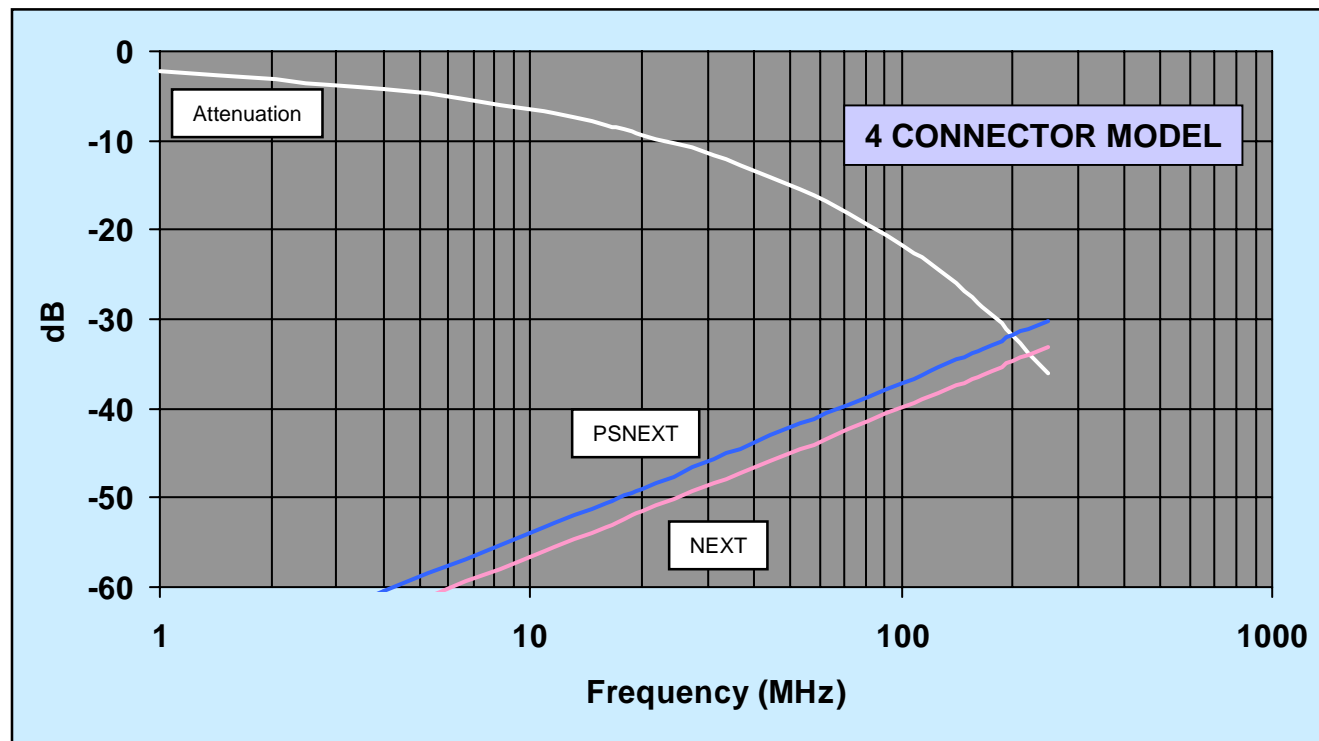
Existing standards text from BS EN 50173 (1995)

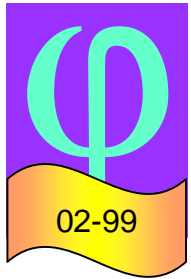
„Cables and connecting hardware of different categories may be mixed within a subsystem and/or the cabling link, but the transmission characteristics of the link will be determined by the category of the least performing component.“



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

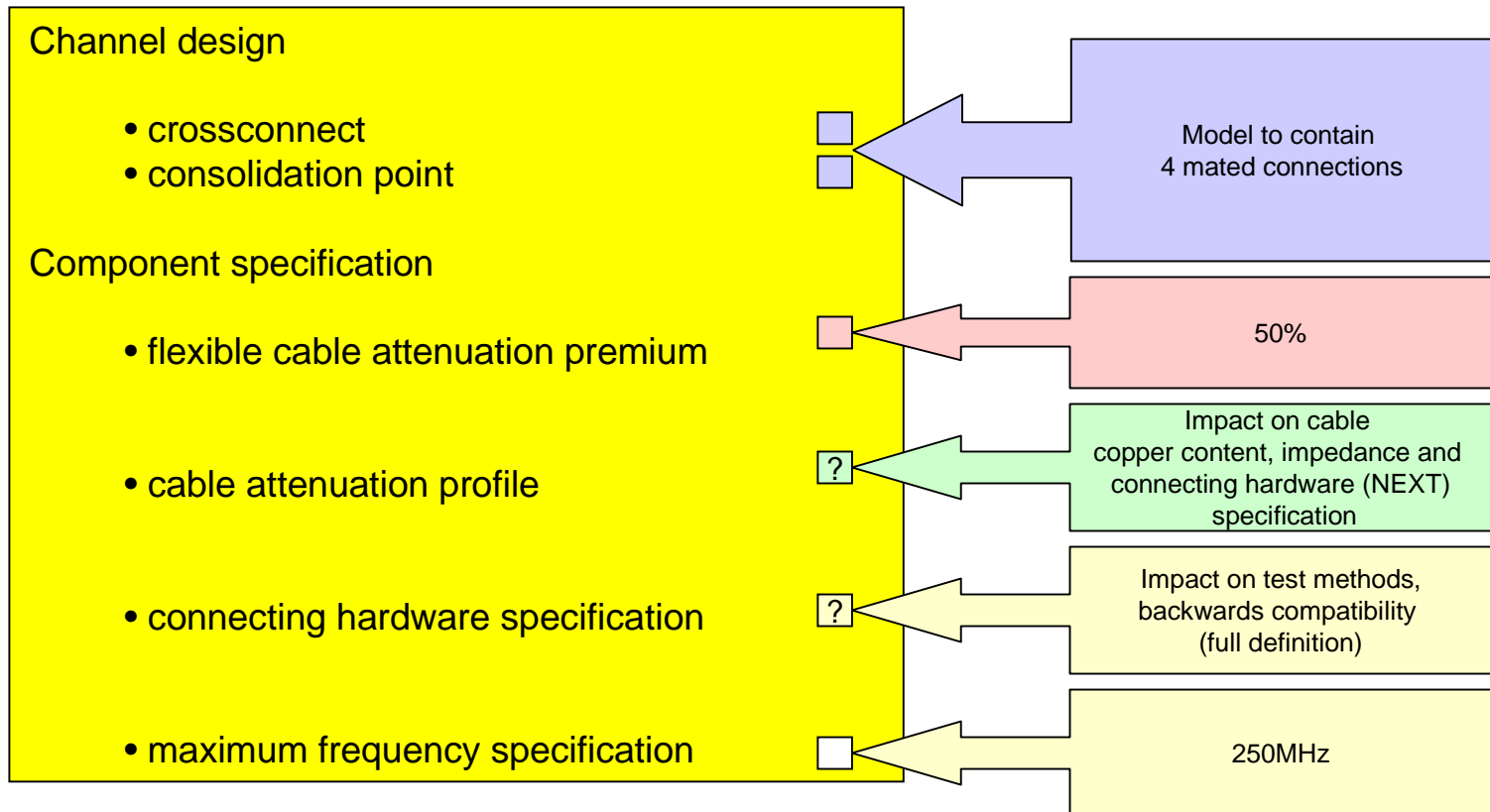
# “Class E” Channel (05/98)

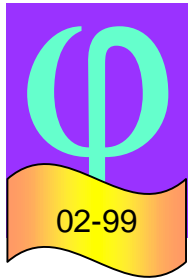




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

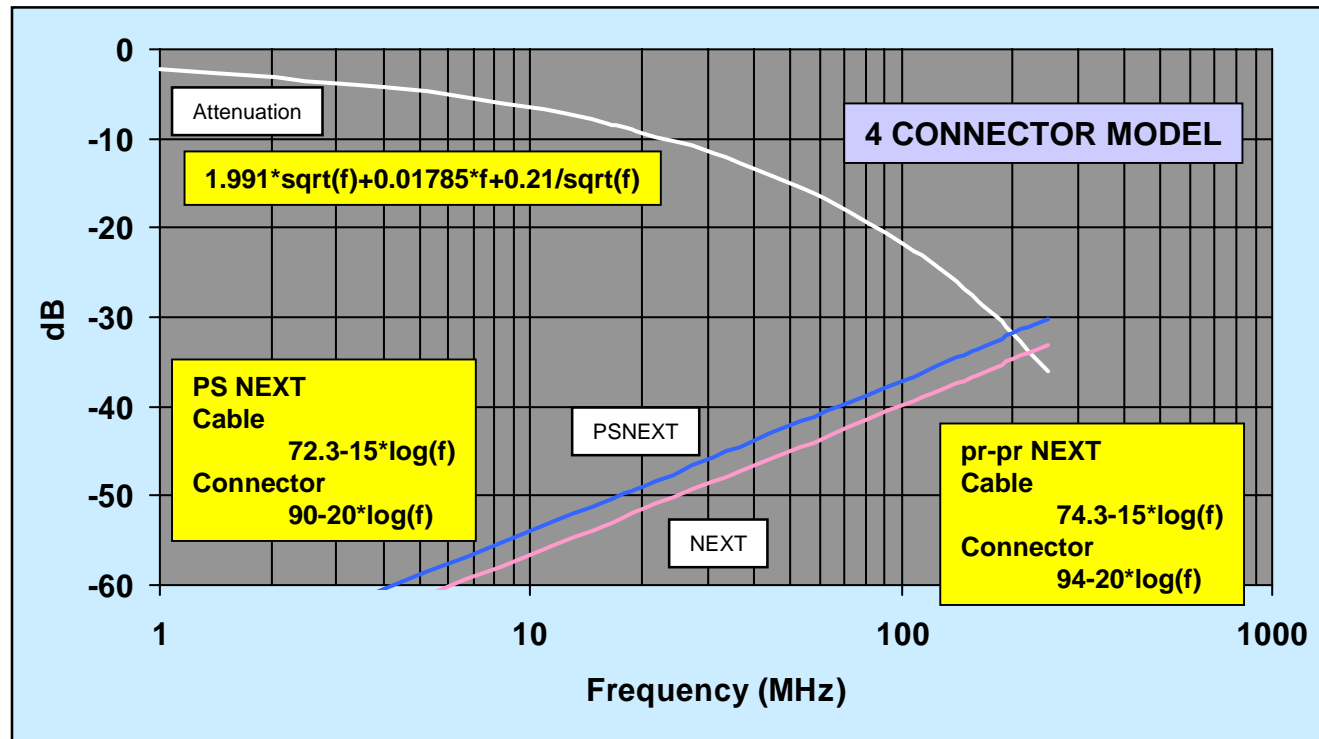
# “Class E” Status (05/98)

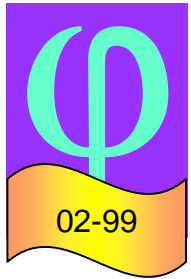




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

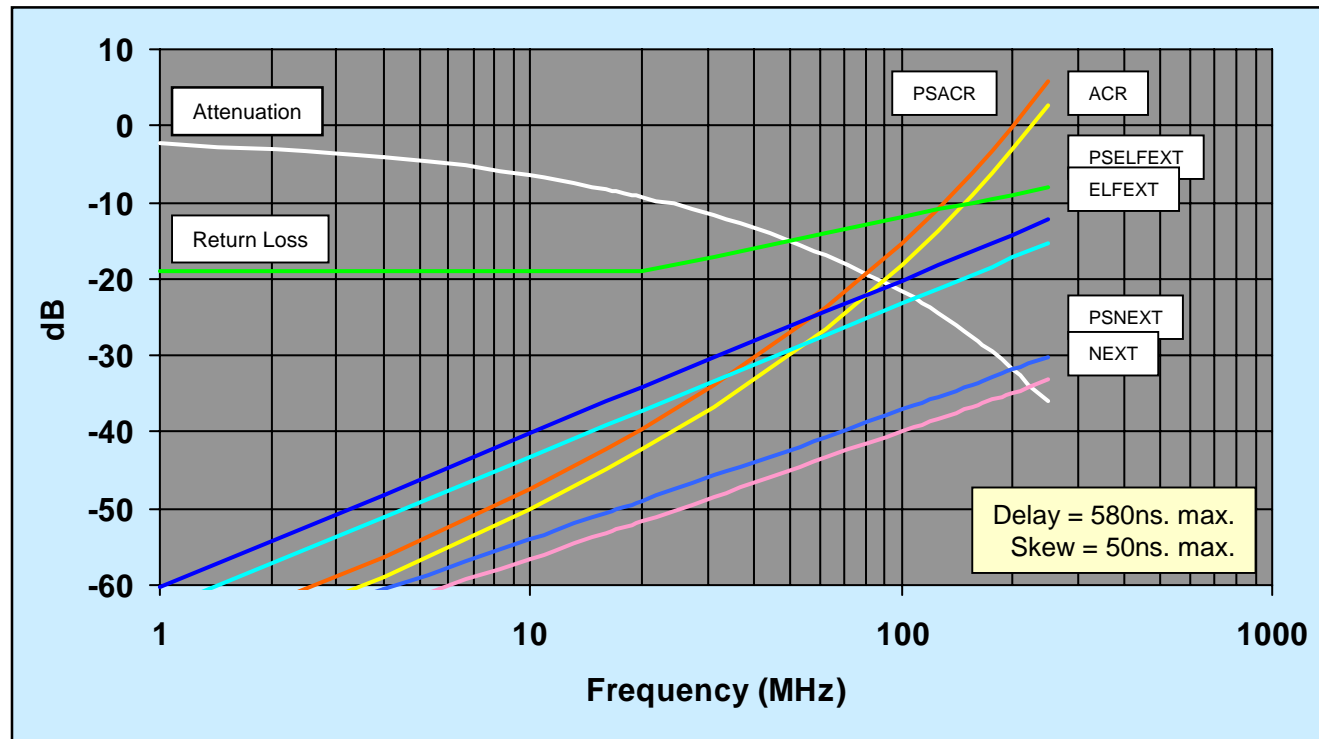
# “Class E” Channel (Mexico) - I

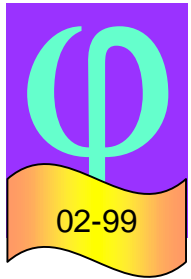




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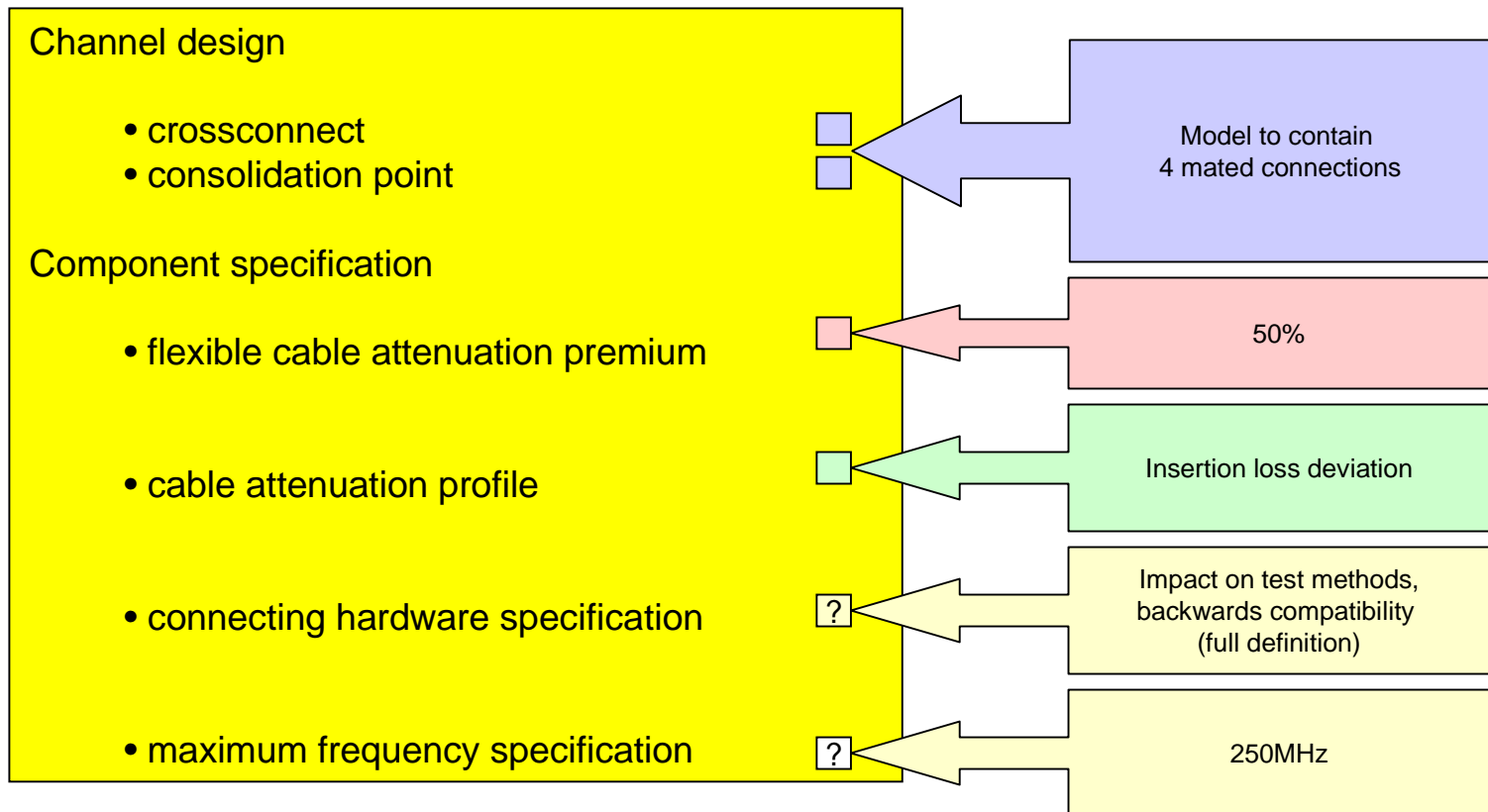
# “Class E” Channel (Mexico) - II

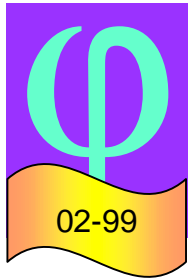




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# “Class E” Status (01/99)

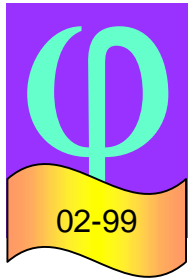




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

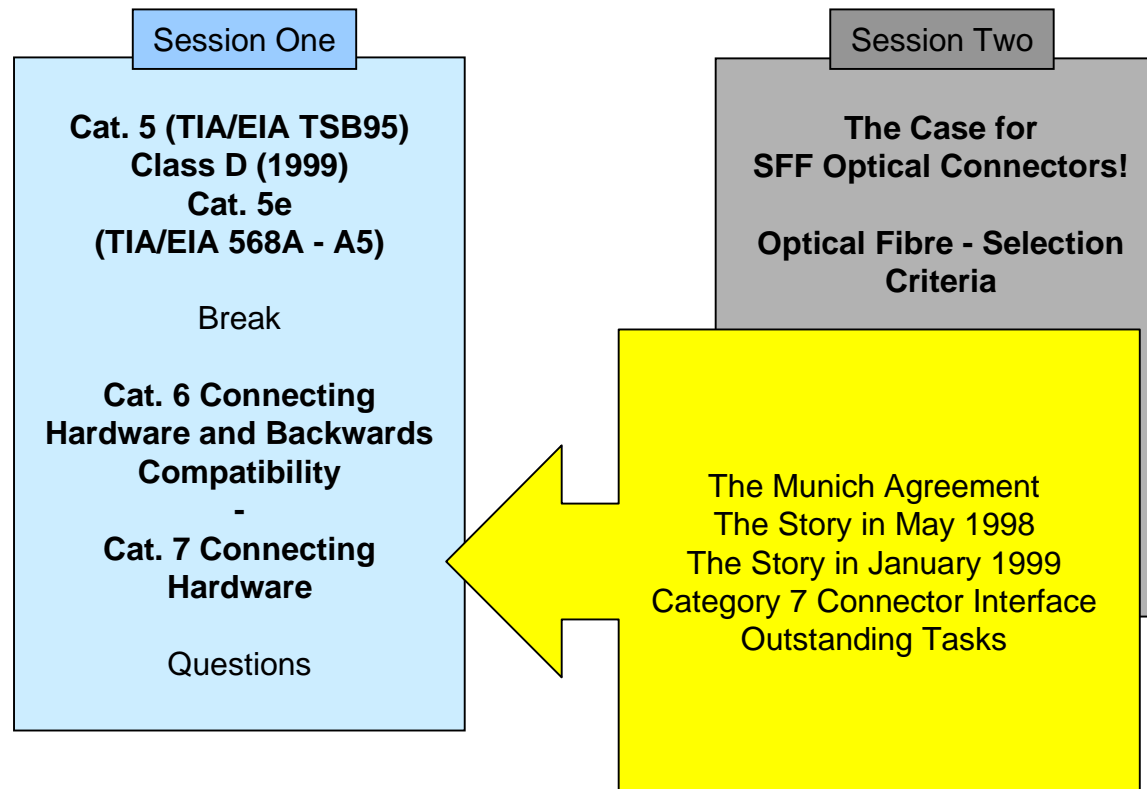
# Cat. 6 Outstanding Tasks

- cable specification
  - insertion loss deviation
  - patch cord premium
- connecting hardware specification
  - multi-vendor interoperability
    - Cat. 6 mix
  - backwards compatibility
    - Cat. 5 mix



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda





DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# The Munich Agreement

- **Class E - Category 6**
  - 4 pair solution
  - 4 connection model (CP and CC)
  - positive PSACR at 200MHz
  - supported over
    - unscreened balanced pairs
    - foil screened balanced pairs
    - IEC 60603-7 connectivity

- **Class F - Category 7**
  - 4 pair solution
  - 4 connection model (CP and CC)
  - positive PSACR at 600MHz
  - supported over
    - individually screened balanced pairs
    - new connector

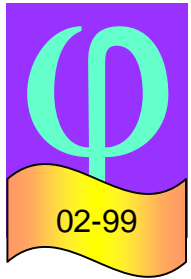
Existing standards text from BS EN 50173 (1995)

„Links of a given class will support all applications of a lower link class.

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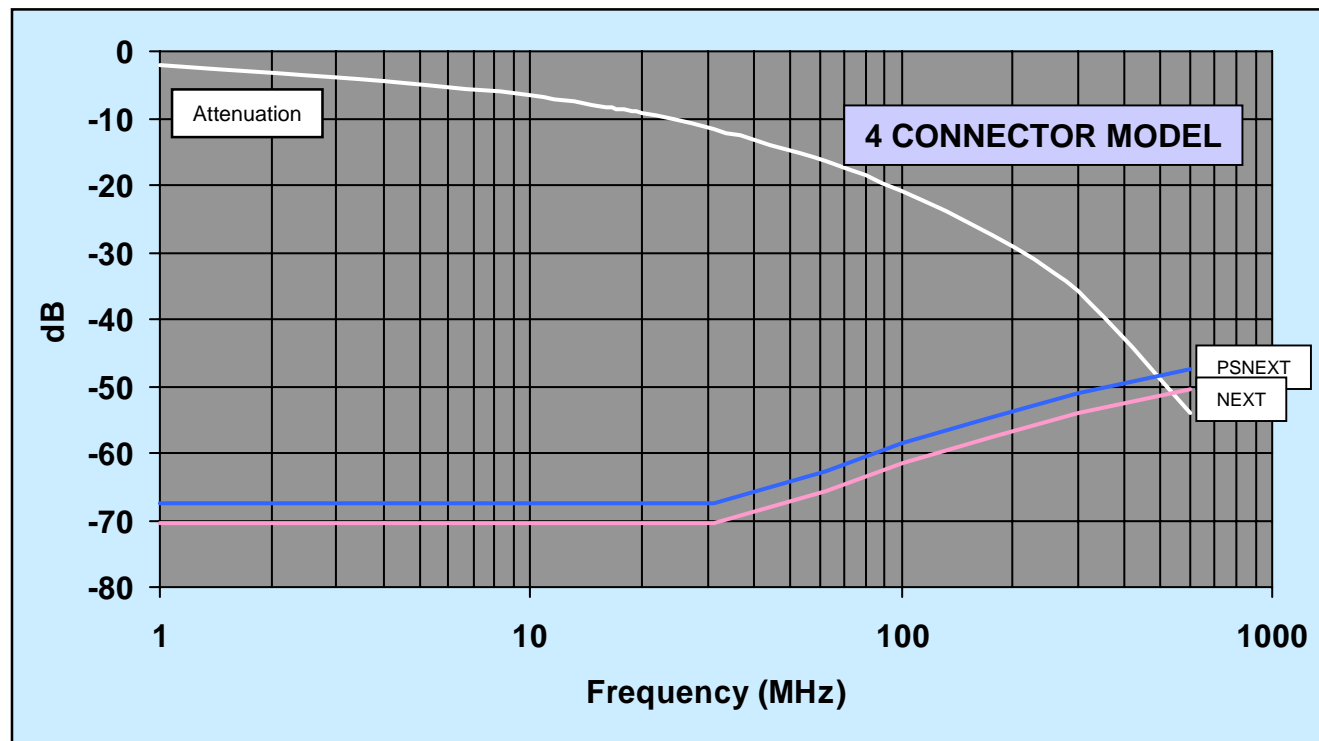
Existing standards text from BS EN 50173 (1995)

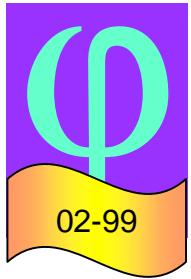
„Cables and connecting hardware of different categories may be mixed within a subsystem and/or the cabling link, but the transmission characteristics of the link will be determined by the category of the least performing component.“



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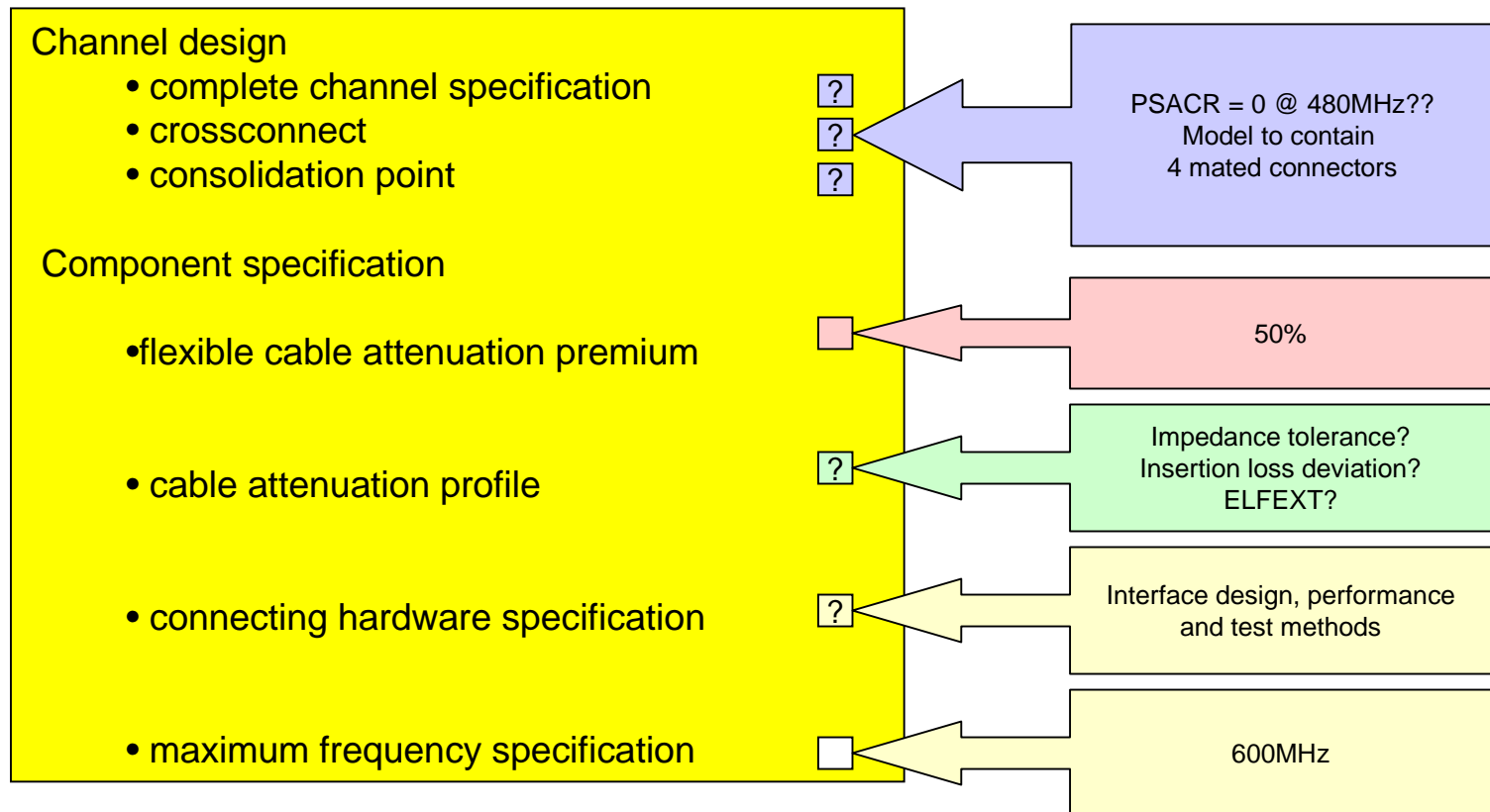
# “Class F” Channel (05/98)

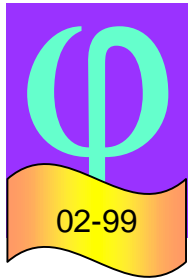




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

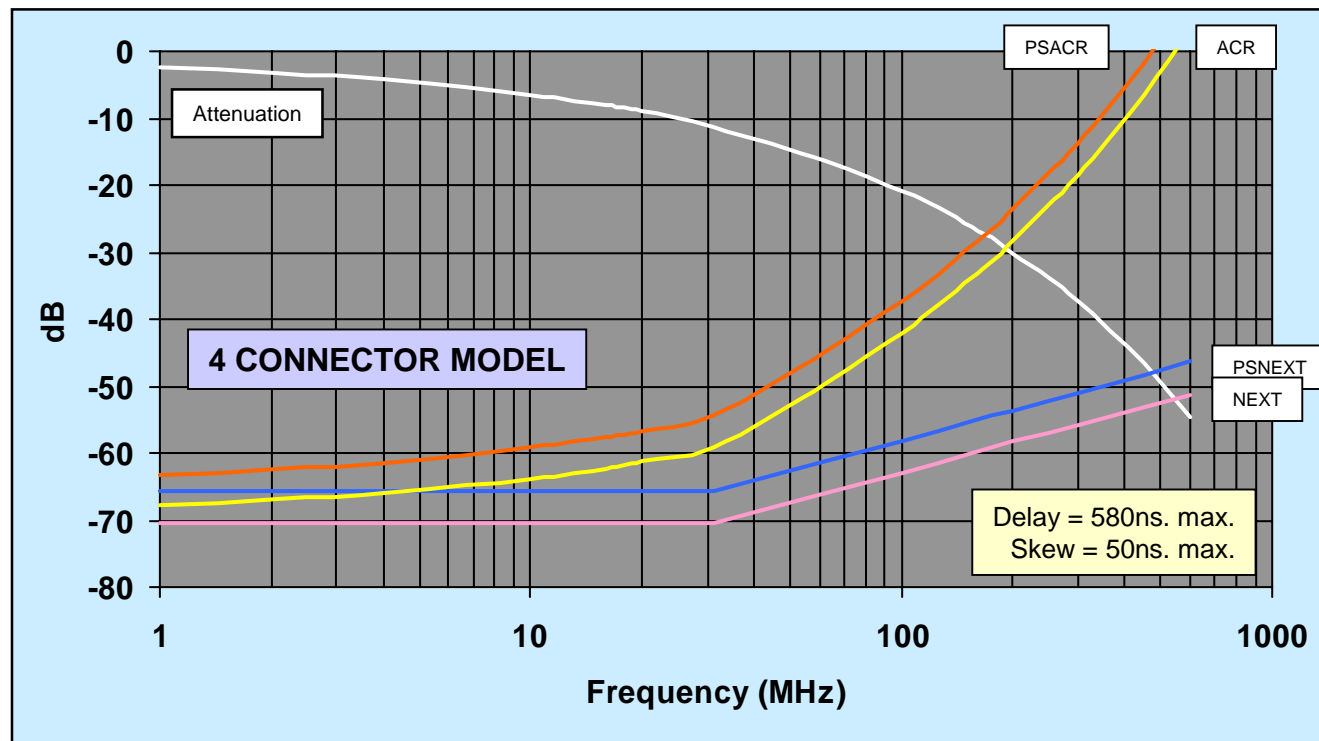
# “Class F” Status (05/98)

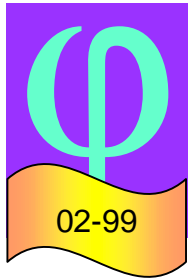




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

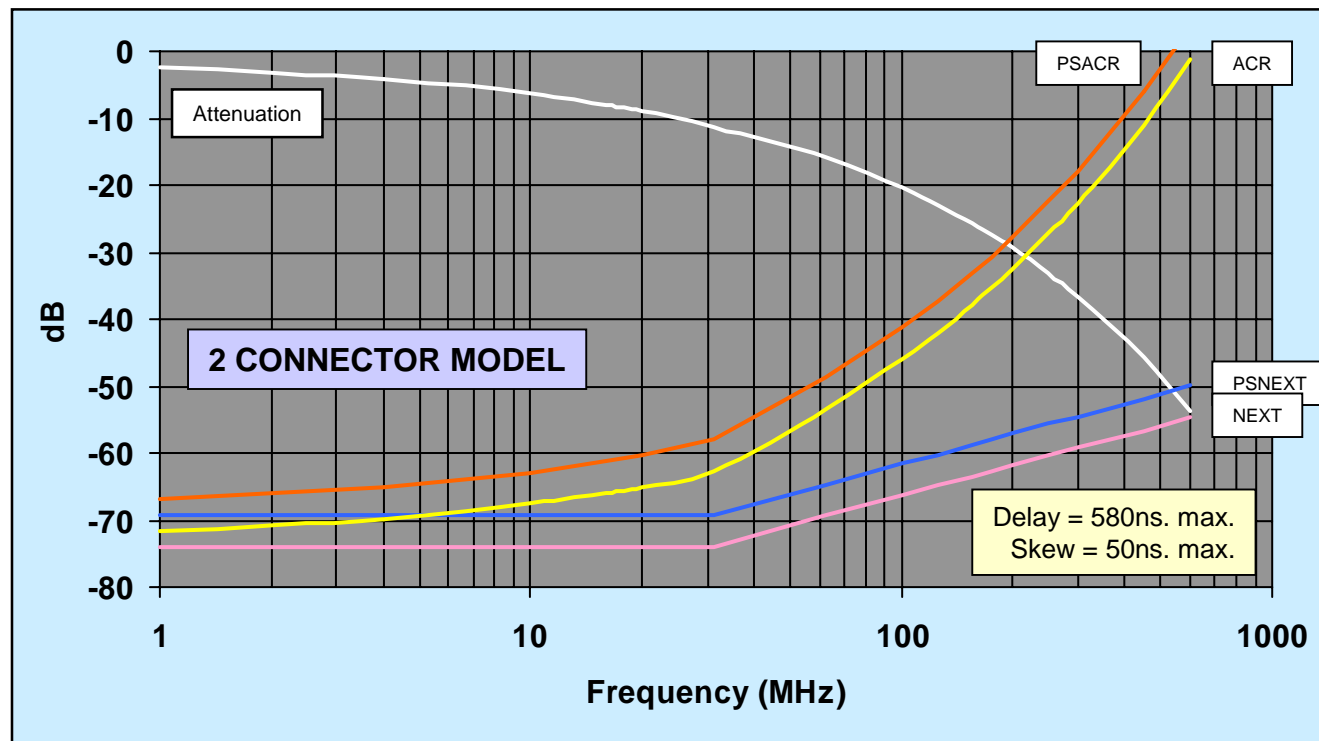
# “Class F” Channel (Mexico) - I

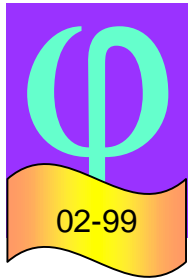




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

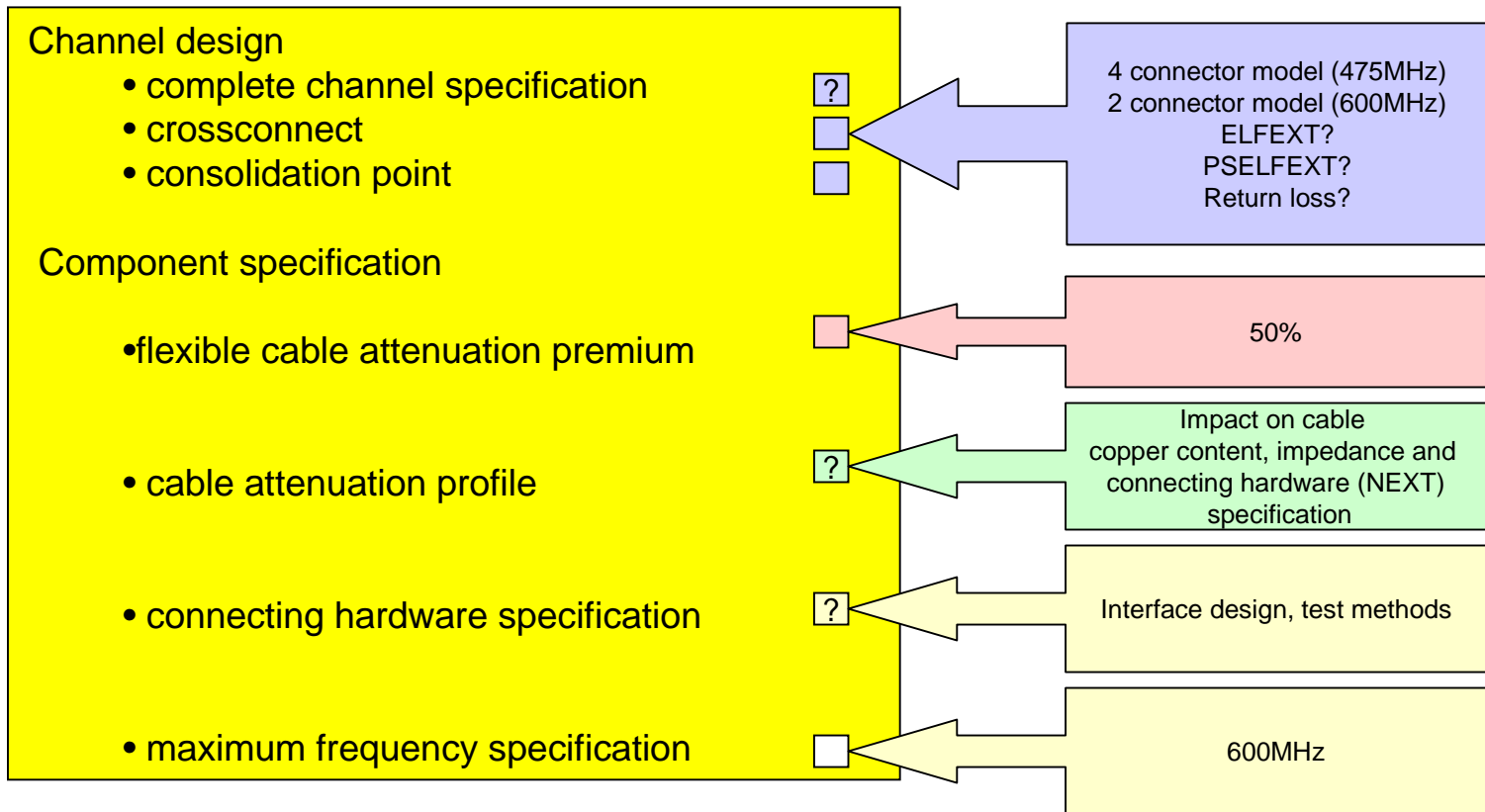
# “Class F” Channel (Mexico) - II

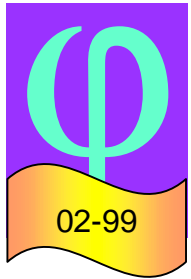




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# “Class F” Status (01/99)

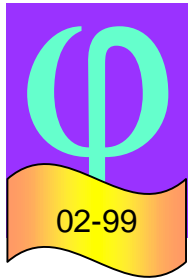




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Cat. 7 Connector Interface

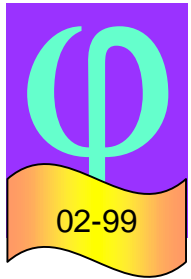
- plan for Mexico (January 99)
  - 9 connector “shoot-out”
    - 2 pr. RJ45
    - RJ45
      - Alcatel
      - AMP
    - other
      - Siemon
      - Telesafe
      - Sofim
      - Thomas & Betts
      - BKS
      - Germany (Harting)
- outcome of Mexico
  - RJ45 solution preferred
    - Alcatel/AMP interworking
      - Berlin, June 1999
  - fallback to be selected
    - panel of “independent” experts
      - April 1999
    - pre-defined criteria
    - submission to SC25 WG3
      - Berlin, June



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

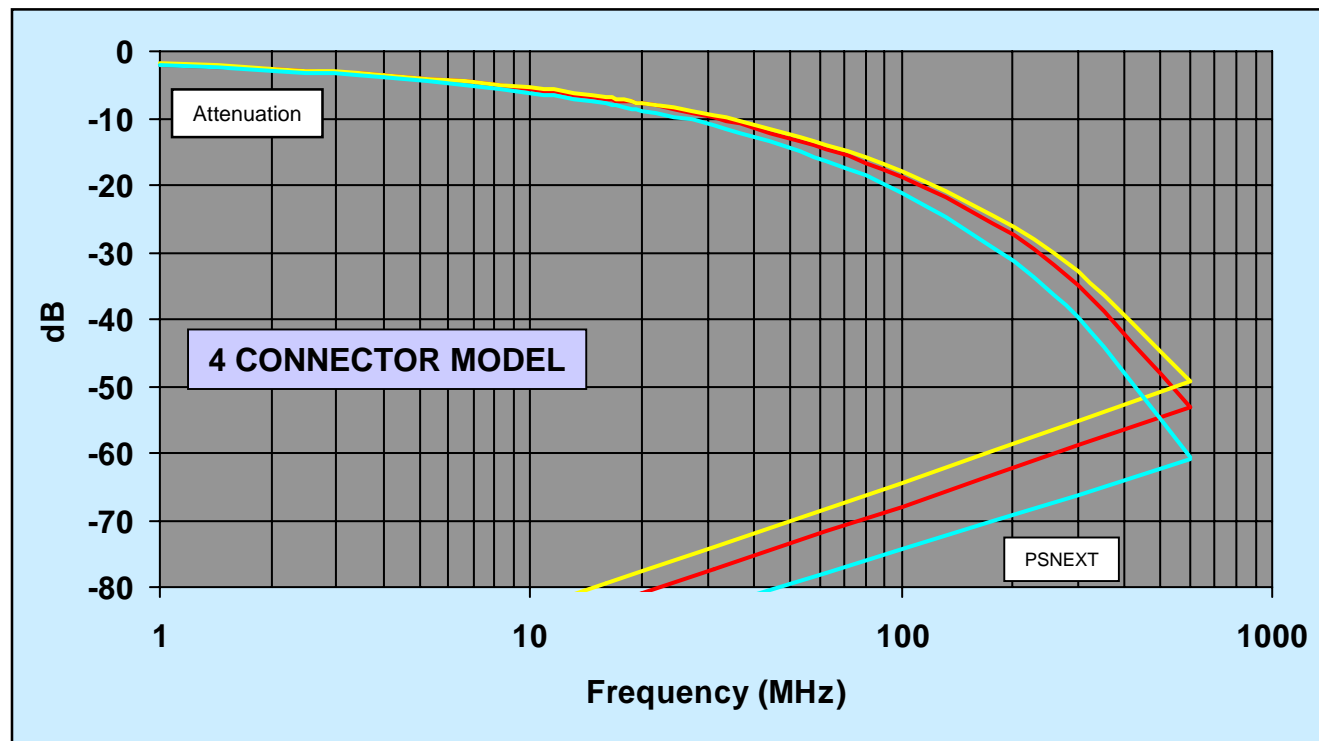
# Cat. 7 - Outstanding Tasks

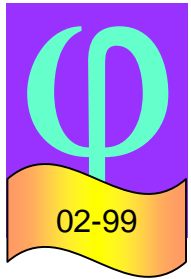
- cable specifications
  - complete parameter set
- connecting hardware specification
  - possible re-specification
    - 600MHz 4-connector channel
  - for RJ45 or other (via adaptors)
    - multi-vendor interoperability
      - Cat. 7 mix
  - RJ45 or other (via adaptors)
    - backwards compatibility
      - Cat. 6 mix, Cat. 5 mix
- link and channel specifications
  - testing
    - certain parameters appear impossible to test “cost effectively”



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

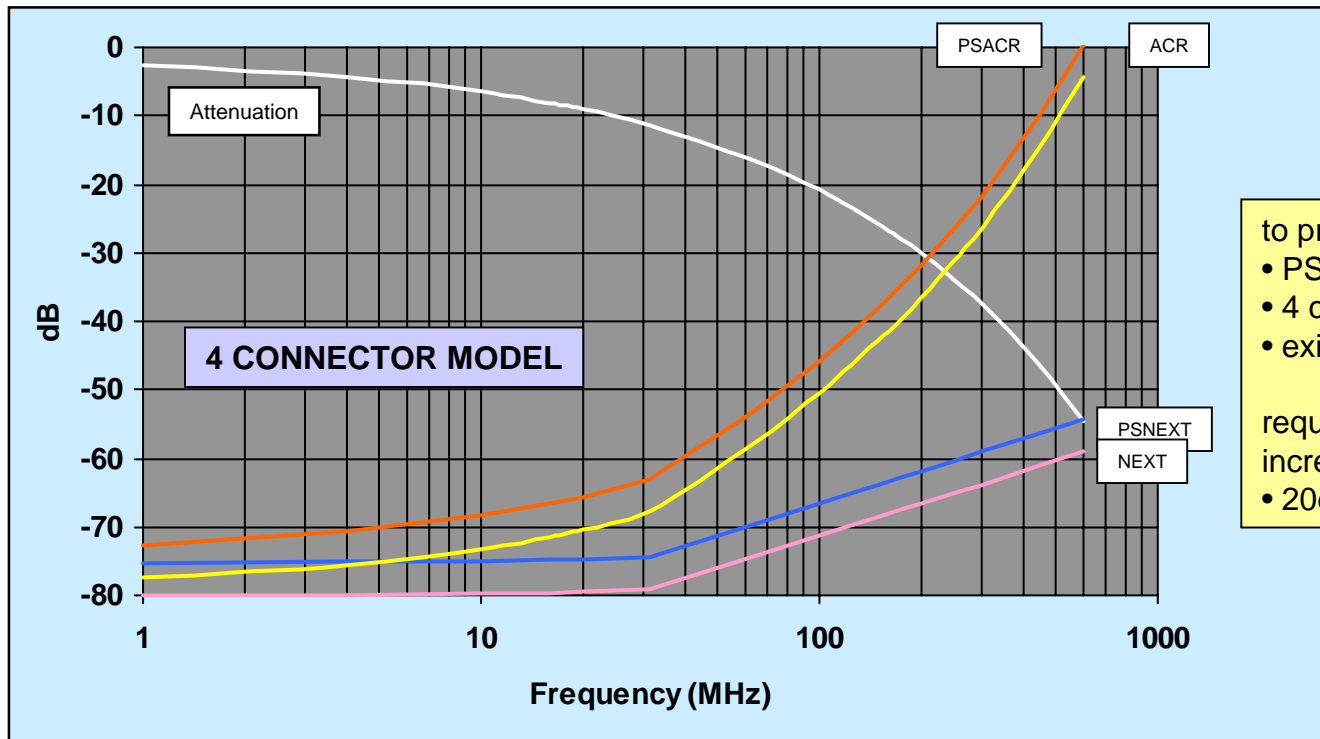
# Class F Alternatives





DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# 600MHz 4-Connector Channel

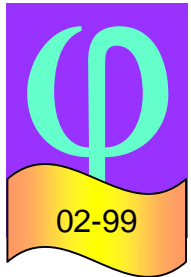


to provide a 600MHz channel

- PSACR = 0
- 4 connectors
- existing cable

requires connector NEXT increase

- 20dB @ 600MHz



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda

## Session One

**Cat. 5 (TIA/EIA TSB95)  
Class D (1999)  
Cat. 5e  
(TIA/EIA 568A - A5)**

Break

**Cat. 6 Connecting  
Hardware and Backwards  
Compatibility**

-

**Cat. 7 Connecting  
Hardware**

Questions

## Session Two

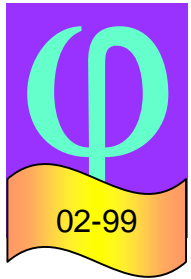
**The Case for  
SFF Optical Connectors!**

**Optical Fibre - Selection  
Criteria**

Break

**Milestones and Millstones**

Questions



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda

## Session One

**Cat. 5 (TIA/EIA TSB95)  
Class D (1999)  
Cat. 5e  
(TIA/EIA 568A - A5)**

Break

**Cat. 6 Connecting  
Hardware and Backwards  
Compatibility**

-

**Cat. 7 Connecting  
Hardware**

Questions

Lunch

## Session Two

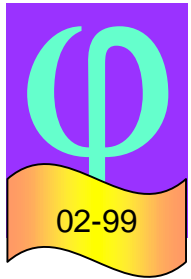
**The Case for  
SFF Optical Connectors!**

**Optical Fibre - Selection  
Criteria**

Break

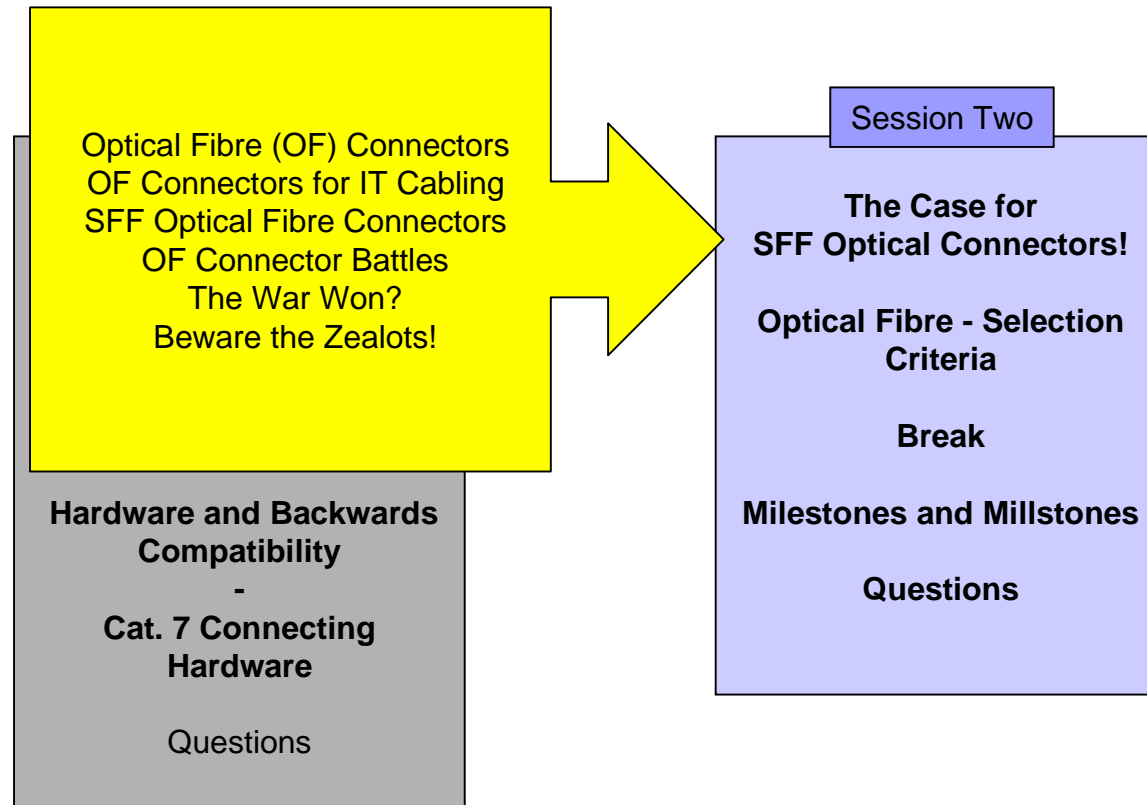
**Milestones and Millstones**

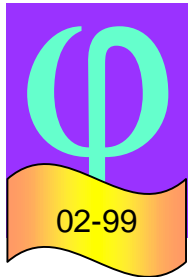
Questions



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda

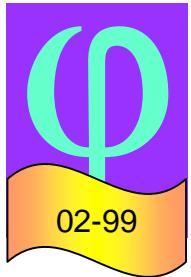




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Optical Fibre (OF) Connectors

Type	Plug	Interface
F-SMA	IEC60874-02	
CF-03	IEC60874-03	
CF-04	IEC60874-04	
BAM	IEC60874-05	
LSA	IEC60874-06	IEC61754-3
FC	IEC60874-07	
D	IEC60874-08	
OF-2	IEC60874-09	
BFOC2,5	IEC60874-10	
OCCA-PC	IEC60874-11	
OCCA-BU	IEC60874-12	
CF-08	IEC60874-13	IEC61754-8
SC	IEC60874-14	IEC61754-4
DS	IEC60874-15	IEC61754-9
MT	IEC60874-16	IEC61754-5
F-05	IEC60874-17	
SC-D	IEC60874-19	
MU		IEC61754-6
MPO		IEC61754-7



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# OF Connectors for IT Cabling

## IS 11801 and EN 50173 Requirements

### TO Type (MMF, SMF)

Green field:	SC Duplex
Legacy:	BFOC/2,5 (ST)

### Mated connection

Installed attenuation (MMF, SMF)	= 0.75dB max.
Return loss (MMF)	= 20dB min.
Return loss (SMF)	= 26dB min.

### Splice

Attenuation (MMF and SMF)	= 0.3dB max.
---------------------------	--------------

## ANSI/TIA/EIA 568A Requirements

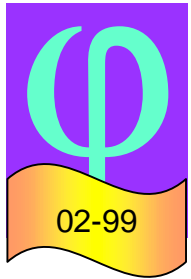
All locations:	SC Duplex
----------------	-----------

### Mated connection

Installed attenuation (MMF, SMF)	= 0.75*dB max.
Return loss (MMF)	= 20dB min.
Return loss (SMF)	= 26dB min.

### Splice

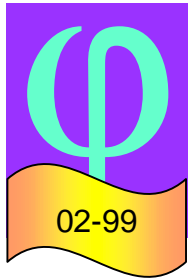
Attenuation (MMF and SMF)	= 0.3dB max.
---------------------------	--------------



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# SFF Optical Fibre Connectors

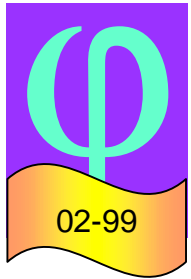
- what is SFF?
  - Small Form Factor
    - duplex termination
    - RJ45 face area
- options include
  - AMP MT-RJ
  - 3M Volition
  - Panduit Opti-Jack
  - Lucent LC
- manufacturers push
  - application standards
    - equipment connectors
  - cabling standards
    - TO connector



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# OF Connector Battles

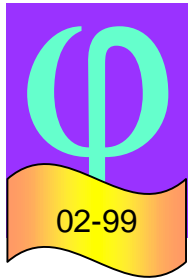
- application standards
  - many new application standards
    - supporting multiple designs
    - no single candidate chosen
- cabling standards
  - TIA/EIA 42.1
    - revision of ANSI/TIA/EIA 568A
      - ANSI/TIA/EIA 568B
      - Part 3 Optical Fibre Cabling
    - SFF considered
      - insufficient support for a change
  - ISO/IEC (and CENELEC?)
    - revision of ISO/IEC 11801
      - TO only specified
      - SFF has few advantages at TO
      - insufficient support for a change



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# The War Won?

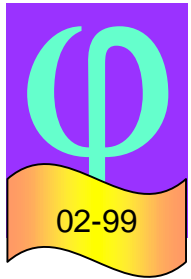
- advantages of SFF
  - small face area
    - benefits for
      - equipment
      - patch panels
    - no benefit for TO
      - OF bend radius defines “backbox” dimensions
  - duplex termination
    - benefits for
      - equipment
      - bi-directional simplex applications
    - may not always be a benefit
- no clear advantage
  - performance
  - overall installation cost
- disadvantages
  - too many choices
  - no clear “winner”
  - none of the contenders are “better enough” to change the cabling standard
- will SFF go away
  - definitely NOT



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

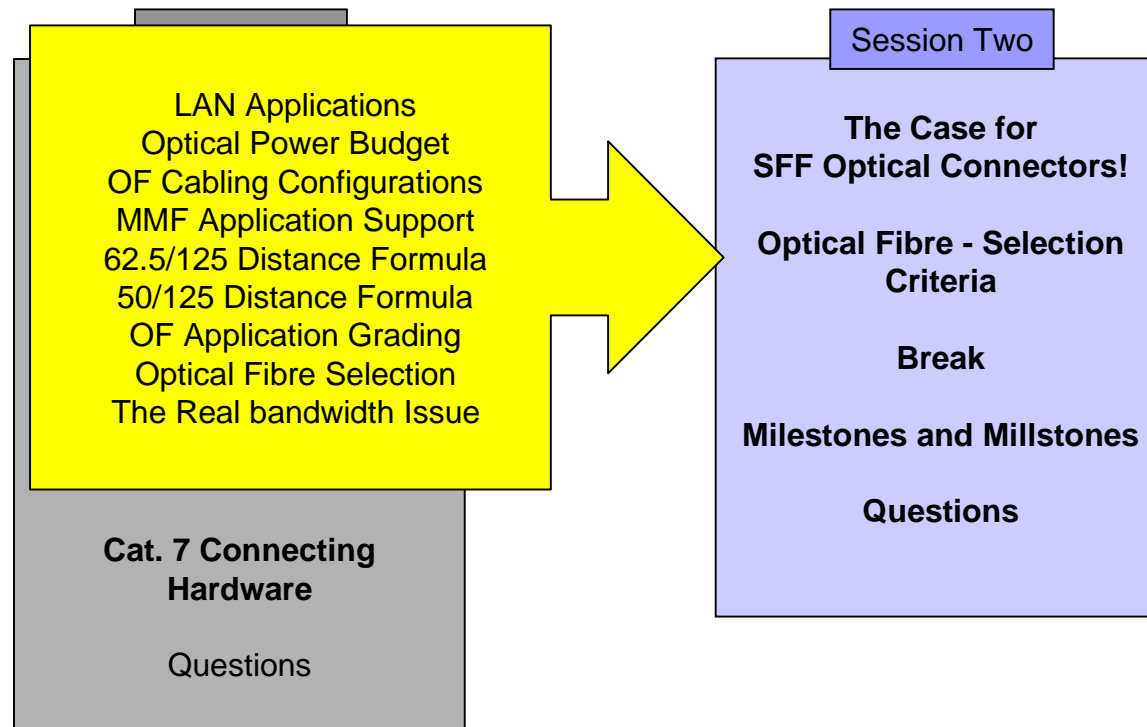
# Beware the Zealots

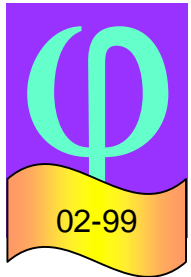
- who are the zealots?
  - The “FTTDAAC” brigade
    - “Fibre To The Desk At All Costs”
    - optical fibre is the only true generic cabling medium
- why are they dangerous?
  - they seek every opportunity to manipulate standards to promote the concept
    - TSB 72
      - 300 metre rule
      - immediately de-valued by 1000BASE-SX
    - new connector
      - new impetus



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda

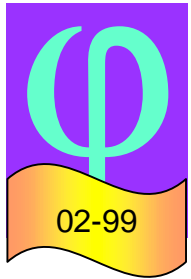




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

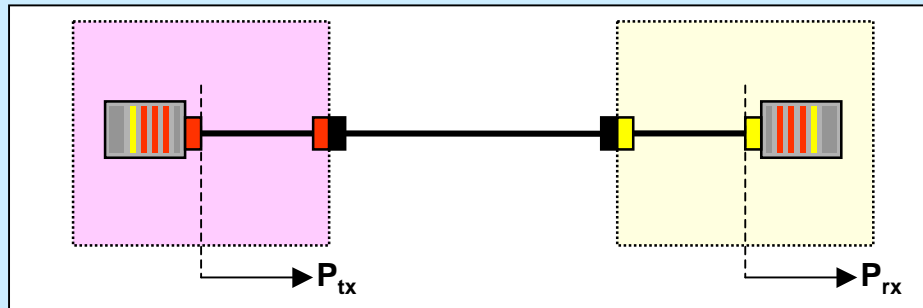
# LAN Applications

MMF 850nm	MMF 1300nm	SMF 1310nm
4Mb/s: Token Ring		
10Mb/s: FOIRL		
16Mb/s: 10BASE-FL/FB		
16Mb/s: Token Ring		
100Mb/s: 100BASE-VG AnyLAN	52Mb/s: ATM	52Mb/s: ATM
	100Mb/s: 100BASE-VG AnyLAN	100Mb/s: FDDI-SMF
	100Mb/s: 100BASE-FX	
	FDDI	
	FDDI-LCF	
	133Mb/s: FibreChannel	
155Mb/s: ATM	155Mb/s: ATM	155Mb/s: ATM
266Mb/s: FibreChannel	266Mb/s: FibreChannel	266Mb/s: FibreChannel
531Mb/s: FibreChannel		531Mb/s: FibreChannel
622Mb/s: ATM		622Mb/s: ATM
1000Mb/s: 1000BASE-SX	622Mb/s: ATM	1000Mb/s: 1000BASE-LX
1062Mb/s: FibreChannel	1000Mb/s: 1000BASE-LX	1062Mb/s: FibreChannel



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Optical Power Budget



**OPB =  $P_{tx} - P_{rx}$  (dB)**

- dependent on injection device
- dependent on optical fibre design

Application	Device	OPB (62.5/125)	OPB (50/125)
10BASE-FL	LED	12.5dB	6.8dB
ATM@155Mb/s	CD LASER	7.2dB	7.2dB

**Maximum channel length = (OPB - total connection loss)/cable attenuation**



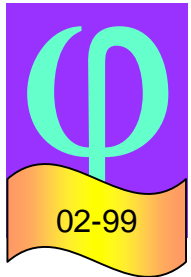


## DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# MMF Application Support

APPLICATION	Wave-length (nm)	62.5/125 3.5/1.5 dB/km 200/500 MHzkm		50/125 3.5/1.5 dB/km 500/500 MHzkm	
		Channel length (m)	OLB (dB)	Channel length (m)	OLB (dB)
Distances specified assume 1.5dB max. of connection loss					
ISO/IEC 9314-3: FDDI PMD	1300	2000	11.0	2000	6.0
ISO/IEC 8802-3: 100BASE-FX	1300	2000	11.0	2000	6.0
ATM @ 52 Mb/s	1300	2000	10.0	2000	5.3
ATM @ 155 Mb/s	1300	2000	10.0	2000	5.3
ISO/IEC TR 11802-4: 4 & 16 Mb/s Token Ring	850	2000	13.0	1850	8.0
ISO/IEC 8802-3:10BASE-FL & FB	850	2000	12.5	1514	6.8
IEEE 802.12: Demand Priority	1300	2000	7.0	800	2.3
CD 14165-1: FibreChannel (FC-PH) @ 266 Mb/s	1300	1500	6.0	1000	5.5
CD 14165-1: FibreChannel (FC-PH) @ 133 Mb/s	1300	1500	6.0	-	1.3
<b>ATM @ 155 Mb/s<sup>1</sup></b>	850	1000	7.2	1000	7.2
ISO/IEC 8802-3: FOIRL	850	1000	9.0	514	3.3
CD 14165-1: FibreChannel (FC-PH) @ 266 Mb/s	850	700	12.0	1500	12.0
<b>IEEE 802.3: 1000BASE-LX<sup>1</sup></b>	1300	550	<b>2.35</b>	550	<b>2.35</b>
CD 9314-9: FDDI LCF-PMD	1300	500	7.0	500	2.0
IEEE 802.12: Demand Priority	850	500	7.5	371	2.8
ATM @ 622 Mb/s	1300	500	6.0	330	2.0
CD 14165-1: FibreChannel (FC-PH) @ 531 Mb/s	850	350	8.0	1500	8.0
<b>ATM @ 622 Mb/s<sup>1</sup></b>	850	300	4.0	300	4.0
<b>CD 14165-1: FibreChannel (FC-PH) @ 1062 Mb/s<sup>1</sup></b>	850	300	4.0	300	4.0
<b>IEEE 802.3: 1000BASE-SX<sup>1</sup></b>	850	275	<b>2.6</b>	550	<b>3.56</b>

<sup>1</sup> These applications are bandwidth limited at the channel lengths shown. The use of lower attenuation components to produce channels exceeding the values shown cannot be recommended.



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# 62.5/125 Distance Formula

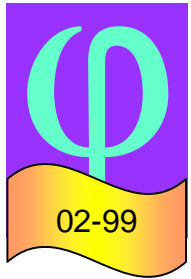
FOR EACH APPLICATION

Channel Length =  $X - nY$   
subject to a maximum  
**CAP**

Connection type	Y (m) 850nm	Y (m) 1300nm
Termination	150	500
Splice	75	250

Application (850nm)	OPB (dB)	X (m)	CAP (m)
Token Ring	12.0	3430	2000
10BASE-FL	12.5	3570	2000
10BASE-FB	12.5	3570	2000
1000BASE-SX	2.6	740	275
ATM155	7.2	2050	1000
ATM622	4.0	1140	300

Application (1300nm)	OPB (dB)	X (m)	CAP (m)
100BASE-FX	11.0	11000	2000
FDDI	11.0	11000	2000
1000BASE-LX	2.35	2350	550
ATM52	10.0	10000	2000
ATM155	10.0	10000	2000
ATM622	6.0	6000	500



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# 50/125 Distance Formula

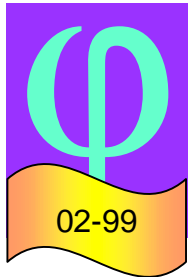
FOR EACH APPLICATION

Channel Length =  $X - nY$   
 subject to a maximum  
**CAP**

Connection type	Y (m) 850nm	Y (m) 1300nm
Termination	150	500
Splice	75	250

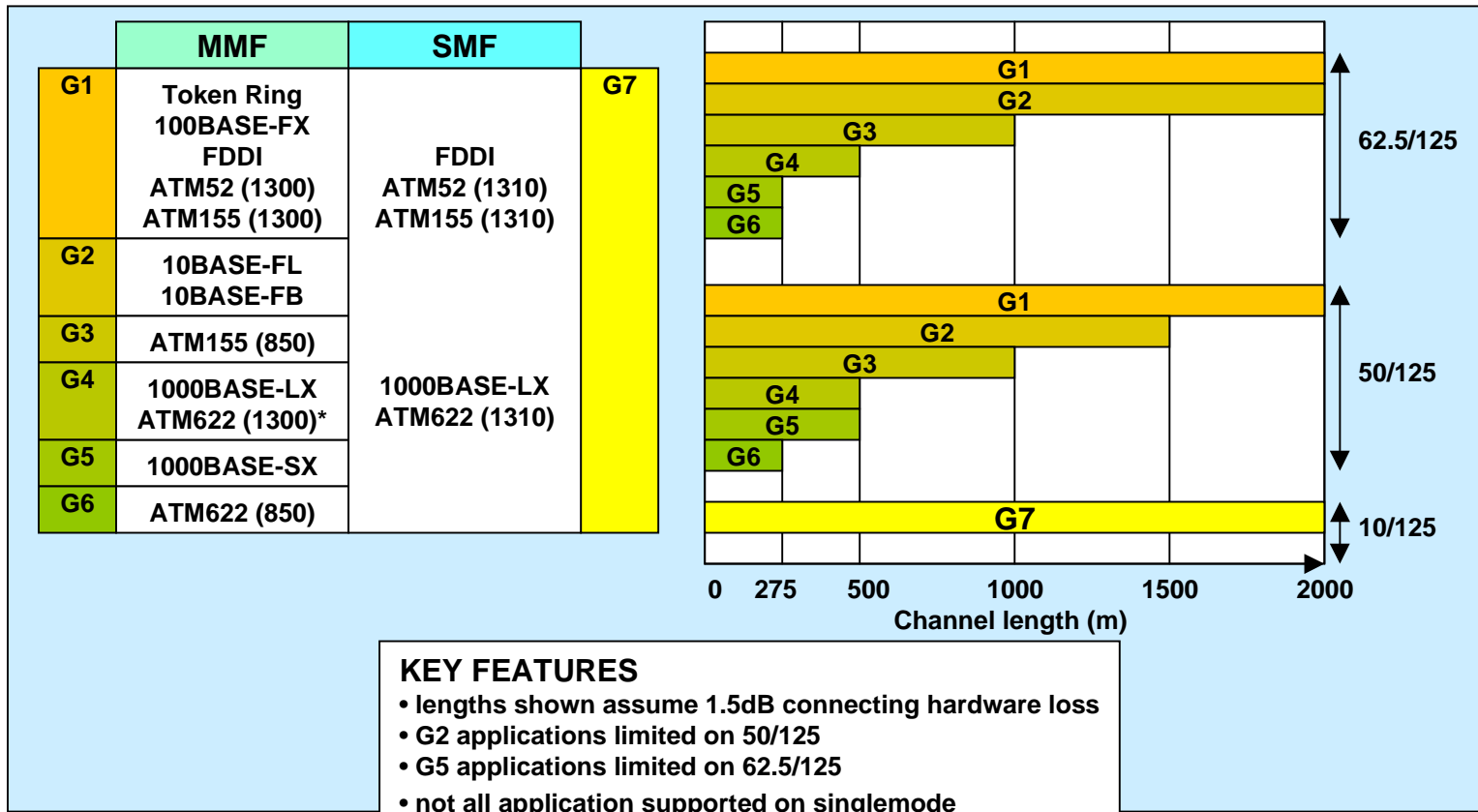
Application (850nm)	OPB (dB)	X (m)	CAP (m)
Token Ring	8.0	2280	<b>2000</b>
10BASE-FL	6.8	1940	<b>1940</b>
10BASE-FB	6.8	1940	<b>1940</b>
1000BASE-SX	3.56	1010	<b>550</b>
ATM155	7.2	2050	<b>1000</b>
ATM622	4.0	1140	<b>300</b>

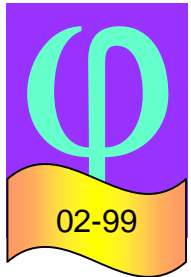
Application (1300nm)	OPB (dB)	X (m)	CAP (m)
100BASE-FX	6.0	6000	<b>2000</b>
FDDI	6.0	6000	<b>2000</b>
1000BASE-LX	2.35	2350	<b>550</b>
ATM52	5.3	5300	<b>2000</b>
ATM155	5.3	5300	<b>2000</b>
ATM622	2.0	2000	<b>300</b>



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# OF Application Grading

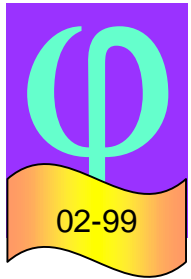




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Optical Fibre Selection

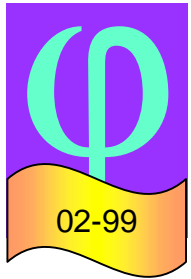
Channel length (m)	OLB (dB)		Design Recommendation
	850nm	1300nm	
0-250	2.35	1.75	50/125 or 62.5/125
250-500	3.25	2.0	50/125 provides support for G5 (lower cost to user) 10/125 should be considered for next generation applications
500-1000	6.8	5.3	50/125 or 62.5/125 with 10/125 included for applications > 500Mb/s
	7.2	10.0	62.5/125 with 10/125 included for applications > 500Mb/s
1000-1500	6.8	6.0	50/125 or 62.5/125 with 10/125 included for applications > 200Mb/s
	12.0	11.0	62.5/125 with 10/125 included for applications > 200Mb/s
1500-2000	6.8	6.0	50/125 or 62.5/125 with 10/125 included for applications > 200Mb/s
	12.0	11.0	62.5/125 with 10/125 included for applications > 200Mb/s



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

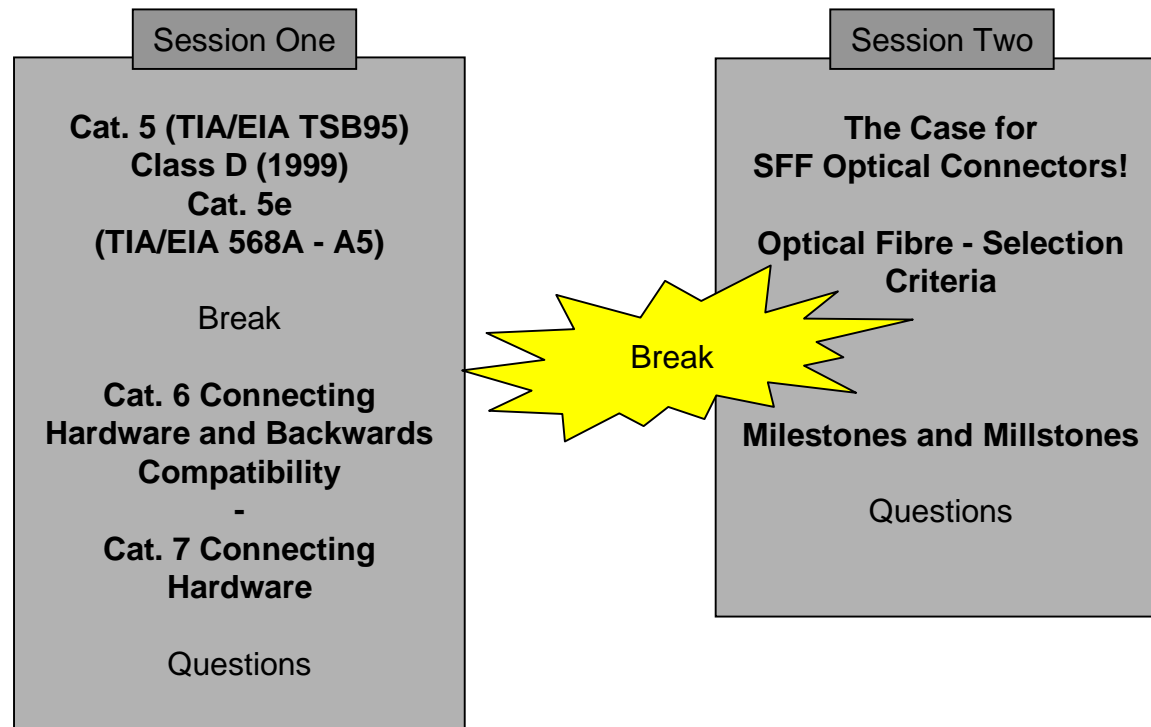
# The Real Bandwidth Issue

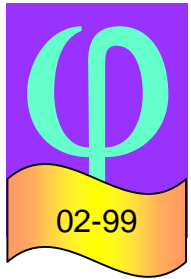
Geometry (µm)	B (MHzkm) 850nm	B (MHzkm) 1300nm	1000BASE-SX • 1st window (850nm) • CD LASER/VCSEL	1000BASE-LX • 2nd window (1300nm) • SM LASER
62.5/125	160	200	220 metres for 160MHzkm	550 metres for 500MHzkm
<b>62.5/125 (ANSI/TIA/EIA 568A)</b>	<b>160</b>	<b>500</b>		
62.5/125	200	200	275 metres for 200MHzkm	550 metres for 500MHzkm
50/125 and 62.5/125	200	400		
<b>IS 11801/EN 50173</b>	<b>200</b>	<b>500</b>	<p>A recent survey by IEC found a total of 73 (50/125) and 43 (62.5/125) dual window combinations</p> <p>These figures are taken from IEC 60793-2 and are for dual window optical fibres</p>	
50/125 and 62.5/125	200	600		
62.5/125	250	1000		
62.5/125	300	800		
50/125	400	400		
50/125	400	600		
50/125	400	800		
50/125	400	1000		
50/125	400	1200		
50/125	400	1500		
<b>50/125 (proposed IS 11801/EN 50173)</b>	<b>500</b>	<b>500</b>	550 metres for 500MHzkm	>550 metres for 500MHzkm
50/125	600	1000		



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

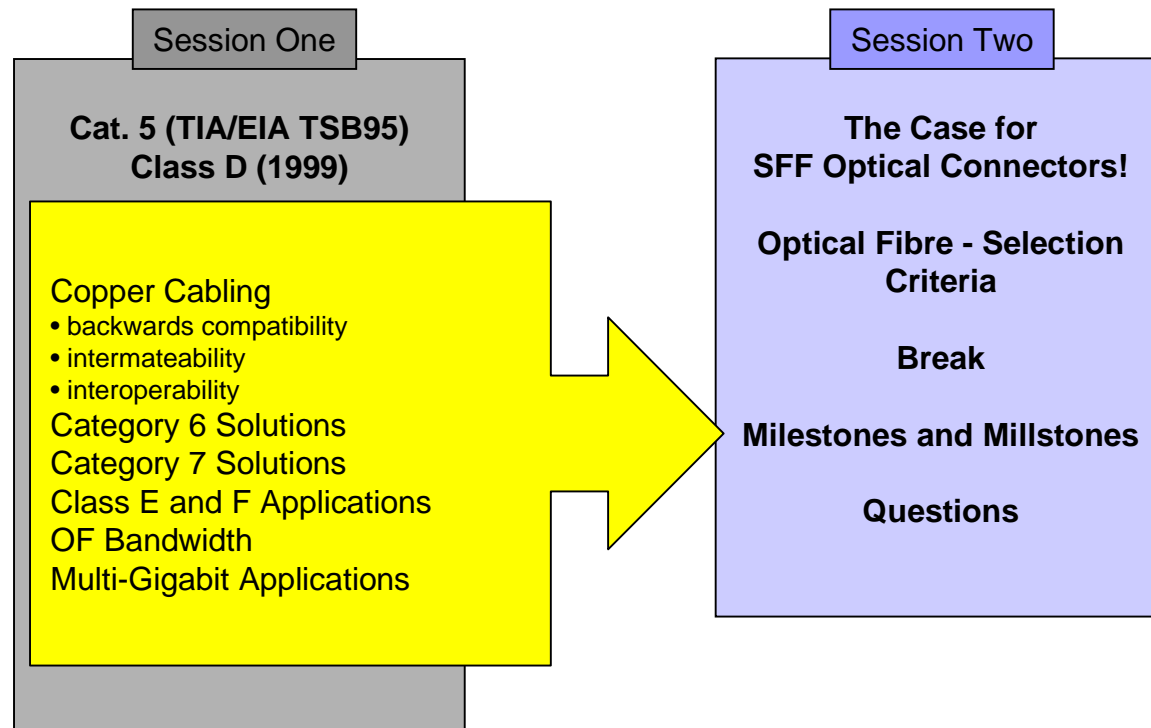
# Agenda

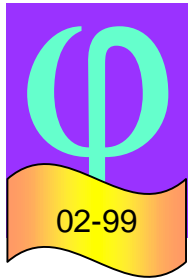




DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Agenda





DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Copper Cabling - I

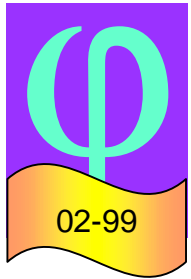
- connecting hardware
  - Cat. 6 backwards compatibility
- risk of performance failure
  - Cat. 5 plug / Cat. 6 socket
  - Cat. 6 plug / Cat. 5 socket
  - test cords
- risk increased by Cat. 5e
- options
  - specify Cat. 5 plugs properly
  - sacrifice backwards compatibility



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Copper Cabling - II

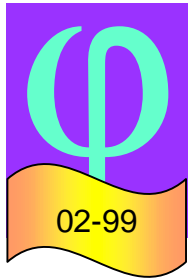
- current IEC connecting hardware standards
  - do not guarantee
    - intermateability
      - physical interworking
    - interoperability
      - electrical interworking
- implications
  - significant re-write of standards
    - connecting hardware
    - cabling
  - proprietary systems



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Category 6 Solutions

- NO products claiming Cat. 6 conformance
  - can guarantee to meet final figures
    - may fail Cat. 6 tests when available
  - can guarantee interoperability with other Cat. 6 products
  - can guarantee backwards compatibility
- all such products represent proprietary solutions
  - procurement of network configuration components may be restrictive



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Category 7 Solutions

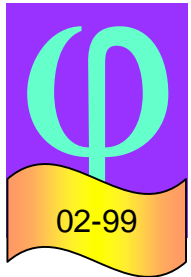
- NO products claiming Cat. 7 conformance
  - can guarantee to meet final figures
    - may fail Cat. 7 tests when available
  - can guarantee interoperability with other Cat. 7 products
  - can guarantee backwards compatibility
- all such products represent proprietary solutions
  - procurement of network configuration components may be restrictive



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# Class E and F Applications

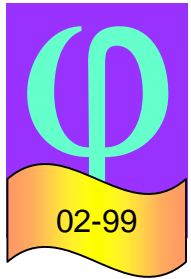
- Class E
  - existing protocols
    - lower cost applications
      - reduced coding complexity
      - cheaper cards
  - new protocols
    - multi-Gigabit
      - requirements unclear
- Class F
  - as Class E
  - broadband video
    - no standards
    - Class F may not have adequate transmission performance



DATA CABLING - CRAWLING OUT OF THE MELTING POT?

# OF Bandwidth

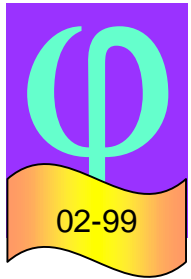
Geometry (µm)	B (MHzkm) 850nm	B (MHzkm) 1300nm	1000BASE-SX • 1st window (850nm) • CD LASER/VCSEL	1000BASE-LX • 2nd window (1300nm) • SM LASER
62.5/125	160	200	220 metres for 160MHzkm	550 metres for 500MHzkm
<b>62.5/125 (ANSI/TIA/EIA 568A)</b>	<b>160</b>	<b>500</b>		
62.5/125	200	200	275 metres for 200MHzkm	550 metres for 500MHzkm
50/125 and 62.5/125	200	400		
<b>IS 11801/EN 50173</b>	<b>200</b>	<b>500</b>	<p>A recent survey by IEC found a total of 73 (50/125) and 43 (62.5/125) dual window combinations</p> <p>These figures are taken from IEC 60793-2 and are for dual window optical fibres</p>	
50/125 and 62.5/125	200	600		
62.5/125	250	1000		
62.5/125	300	800		
50/125	400	400		
50/125	400	600		
50/125	400	800		
50/125	400	1000		
50/125	400	1200		
50/125	400	1500		
<b>50/125 (proposed IS 11801/EN 50173)</b>	<b>500</b>	<b>500</b>	550 metres for 500MHzkm	>550 metres for 500MHzkm
50/125	600	1000		



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# Multi-Gigabit Applications

- IEEE, March 1999
  - discussions of 10GB/s Ethernet
- transmission options
  - single channel
  - 4 x 2.5GB/s
  - 10 x 1GB/s
- options for optical fibre
  - singlemode
  - multimode
    - higher bandwidth options
    - WDM
    - new geometry
- watch this space
- in the meantime
  - use full and proper specifications



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# Agenda

## Session One

**Cat. 5 (TIA/EIA TSB95)  
Class D (1999)  
Cat. 5e  
(TIA/EIA 568A - A5)**

Break

**Cat. 6 Connecting  
Hardware and Backwards  
Compatibility**

-

**Cat. 7 Connecting  
Hardware**

## Session Two

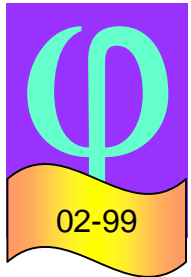
**The Case for  
SFF Optical Connectors!**

**Optical Fibre - Selection  
Criteria**

Break

**Milestones and Millstones**

**Questions**



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# The End

- full colour copy of presentation
  - [www.it-cabling.com/gendocs/cootmp.pdf](http://www.it-cabling.com/gendocs/cootmp.pdf)

**Mike.Gilmore@BTInternet.com**

**Tel: +44 (0) 113 232 3721**

**Fax: +44 (0) 113 293 2632**

- spreadsheet containing current cabling performance models
  - Cat. 5e
  - Cat. 6
  - Cat. 7
- [www.it-cabling.com/gendocs/cootmp.xls](http://www.it-cabling.com/gendocs/cootmp.xls)
  - password "itmp3"